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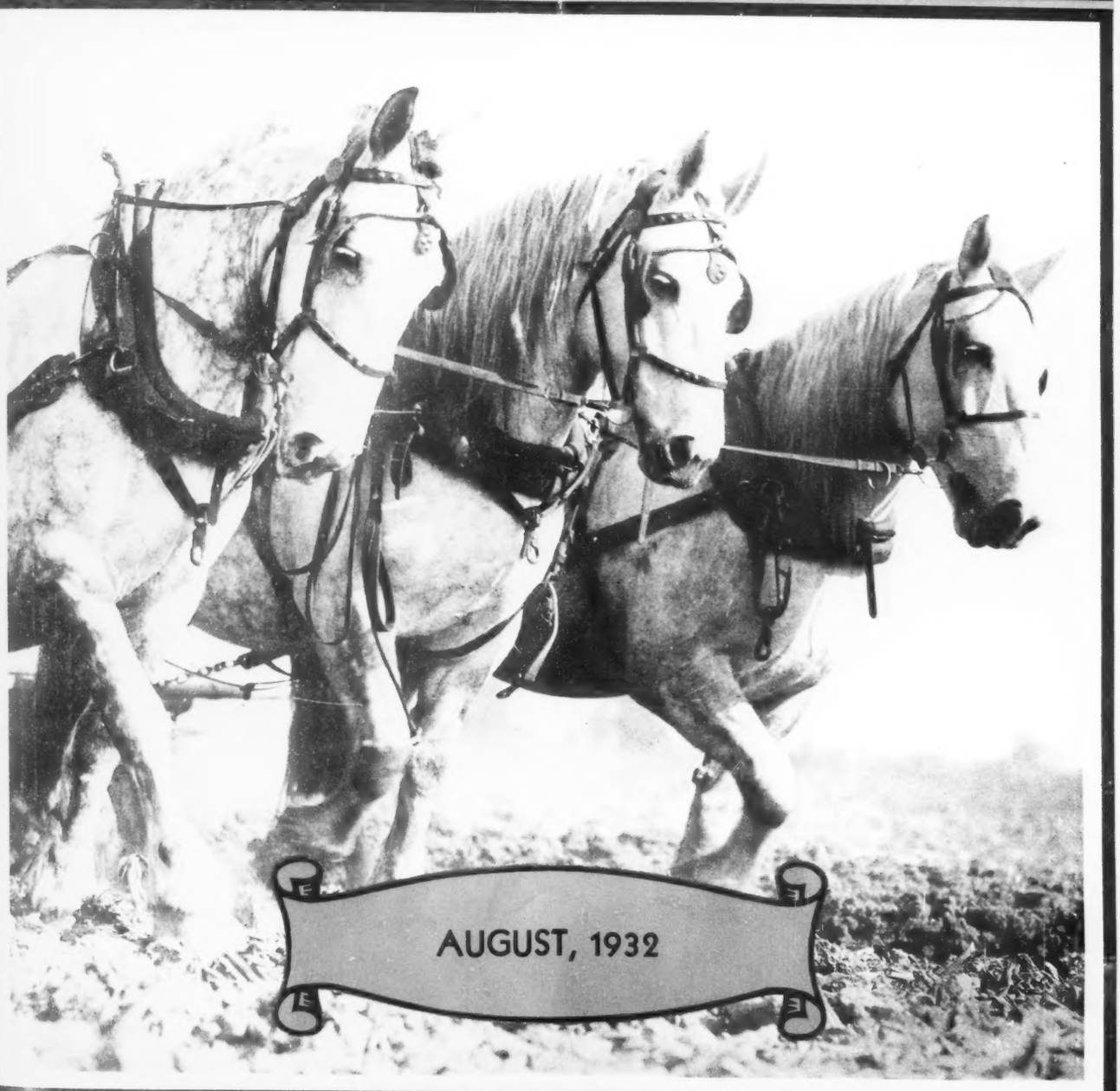
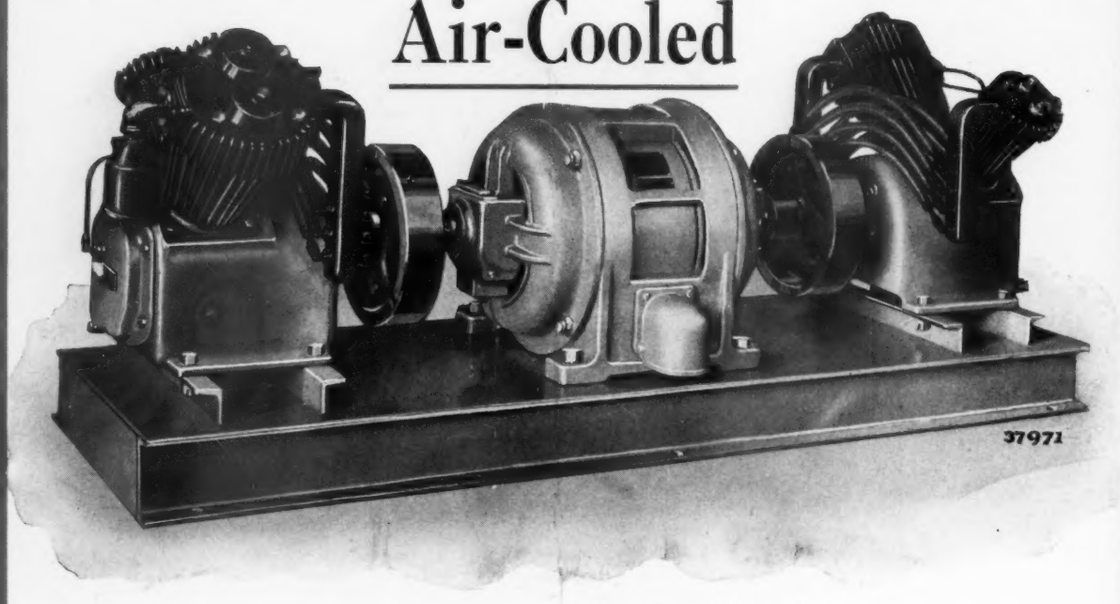


AUGUST, 1932

A New Compressor Unit

Air-Cooled



Type 30, Double-End Compressor

THIS unit is a new arrangement of the successful Ingersoll-Rand Type 30 compressors. It was designed to meet the demand for a larger air-cooled compressor unit than has heretofore been available. It consists of two standard I-R air-cooled, ball-bearing compressors direct-connected to a 20 h.p. electric motor and mounted on a steel base.

The compressors are entirely enclosed, thereby excluding all dust and dirt which would wear out the bearings and other working parts.

Ingersoll-Rand plate valves and air intake filter and muffler insure high efficiency, dependability and quiet operation. These compressors may be furnished either with constant-speed or with automatic start-and-stop control. A built-in centrifugal unloader fully unloads the machine whenever it stops and protects the motor against damage.

They are made in three sizes for operation against different pressures—a 149 c.f.m. unit for 40 lbs. per sq. in. pressure, a 90 c.f.m. unit for 100 lbs. per sq. in. pressure and a 74 c.f.m. unit for 200 lbs. per sq. in. unit.

Ask any I-R branch office for full details on this new machine.

INGERSOLL-RAND COMPANY, 11 Broadway, New York City

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As It Seems To Us

OUR NEW COVER

WE GREET our readers this month with a new cover design. It retains the characteristic color and the general features of layout which have made *Compressed Air Magazine* distinctive and readily distinguishable wherever it goes. At the same time it has been stripped of some of its embellishments; and in its simpler form more space is allotted to the illustration. We trust that the change will strike a favorable chord in a goodly number of our readers; and we hope that we may be able to make the pages that follow the cover equally bright and appealing.

FASTER TUNNEL DRIVING

A NEW technique in driving large-bore tunnels has arisen with the development of drill carriages. The former much-used method of advancing a small heading to afford an opening for the drilling of ring or radial holes has now largely given way to the placing of horizontal holes. Unless the cross section is exceptionally large, virtually the entire breast can be drilled from one set-up.

The first drill carriages were designed twenty years ago by a rock-drill manufacturer as a means of aiding customers to secure added effectiveness from its machines in tunnel-driving. Like all new mechanisms, they were far from perfect, and they were subjected to the doubts and skepticisms which disciples of established practice hold for innovations. These early carriages were small affairs; in fact, the adoption of a rig with places for four drifter drills attracted great attention in the driving of the pilot bore for the 6-mile Moffat Tunnel in Colorado in 1925.

Today the use of drill carriages for tunneling is accepted practice. In this issue we illustrate a 14-drill carriage which enabled a contractor to make an enviable record for speed in driving a large bore in New York State. A similar contrivance was used by the same firm four years ago with such good results that there was no question as to how the current job would be attacked.

The outstanding example among drill carriages is, of course, the one which was used in the Hoover Dam diversion tunnels, and which was described in detail in our April issue. With it, 24 drills were massed in attack upon the rock face. A distinct step forward was the mounting of the carriage upon a standard truck chassis, thereby giving it maximum mobility and eliminating the need for alternately laying and dismantling track such as exists when a carriage is assembled on railroad rolling stock.

There are many advantages in using these ingenious devices. All holes are drilled to a more uniform depth than from other methods of set-up because each drill is relatively equidistant from the face when drilling starts. Holes of uniform depth bring maximum effectiveness from blasting and result in breaking the rock evenly at the back. This, in turn, gives a clean-cut face for the next round. Such advantages as ease of shifting drills and of maintaining a standard round are well known. Then, too, there is a psychological reason why drill carriages produce speedier drilling. The factor of teamwork comes into play and also that of competition. The urge to outdo the other man if possible, or at least to hold up one's end, spurs each drill runner to put forth his best efforts. The footage per man per shift rises perceptibly under such conditions.

FROM DAVY JONES'S LOCKER

GOLD and the sea always have been glamorous subjects. Since the beginning of recorded history they have been synonyms of romance. When the two are linked together there usually results a story of gripping interest. Not always do such tales have a happy ending; and so it may be with the *Artiglio*, Italian salvage ship which recently successfully tapped the bullion room of the sunken liner *Egypt* after a four-year quest.

In the days of rich gold strikes in the West, the finder of valuable ore came to know that from one to a dozen claimants would seek to share it with him. Invariably he had to defend lawsuits, and some bitter court battles were waged. Where there is gold there is litigation. It is not surprising, then, that as soon as the *Artiglio's* intrepid crew put into port with treasure aboard, their captain was served with a writ that probably forebodes long days of legal arguments to determine who shall have the joys and sorrows that inevitably accompany the yellow metal.

The world is not concerned so much with the controversy, however, as with the thrilling exploits of the Italian salvors. The *Egypt*, carrying $5,000,000 in gold and silver in her strong room, sank in 400 feet of water off the coast of France in 1922 after being rammed by a cargo steamer. For several years she lay there with nothing tangible being attempted to reach her. Lloyds really owned the cargo by virtue of having underwritten the vessel on her fateful voyage. In 1929 the Sorima Company of Genoa undertook salvage operations under an agreement to finance the work in return for half the treasure that might be recovered. The original *Artiglio* located the sunken vessel in 1930, and began the precarious work of clearing away the superstructure that guarded the bullion room. Winter forced a suspension of activities; and before the *Artiglio* could return to her task she was blown up while dynamiting a sunken munition ship. Fourteen of her crew perished. Undaunted, the Genoa company outfitted a new *Artiglio* and spent the summer of 1931 in opening the way to the bullion. Cold weather again intervened; but last May the salvors returned, confident that they were near success.

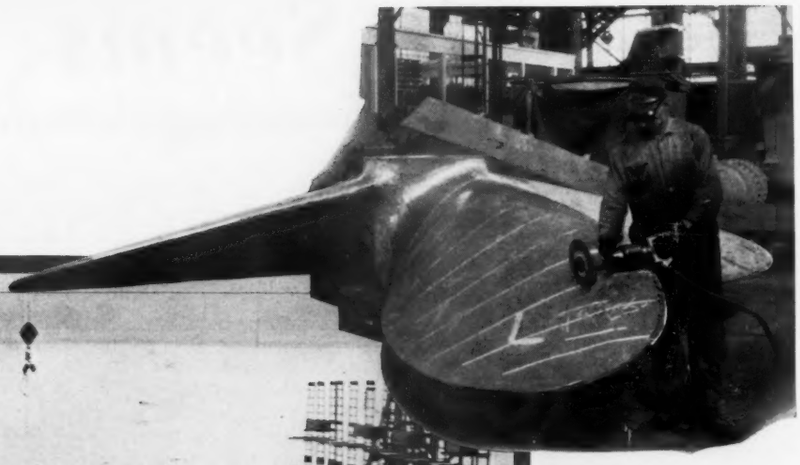
On May 29, divers broke into the compartment where the gold was stored, and on June 12 the grab brought up the first of great quantities of Indian bank notes, once worth millions but now perhaps of no value. Finally, ten days later, the first of the bars of gold and silver came up; and from then on every shot of the grab yielded riches at a faster rate than man ever took them from the ground.

Gold mining of this sort, like that on land, is expensive, but the recoverable values are known at the outset. The pay streak isn't likely to pinch out, and there are no smelting or milling charges. It is reported that the *Artiglio's* operations have cost about $500,000.

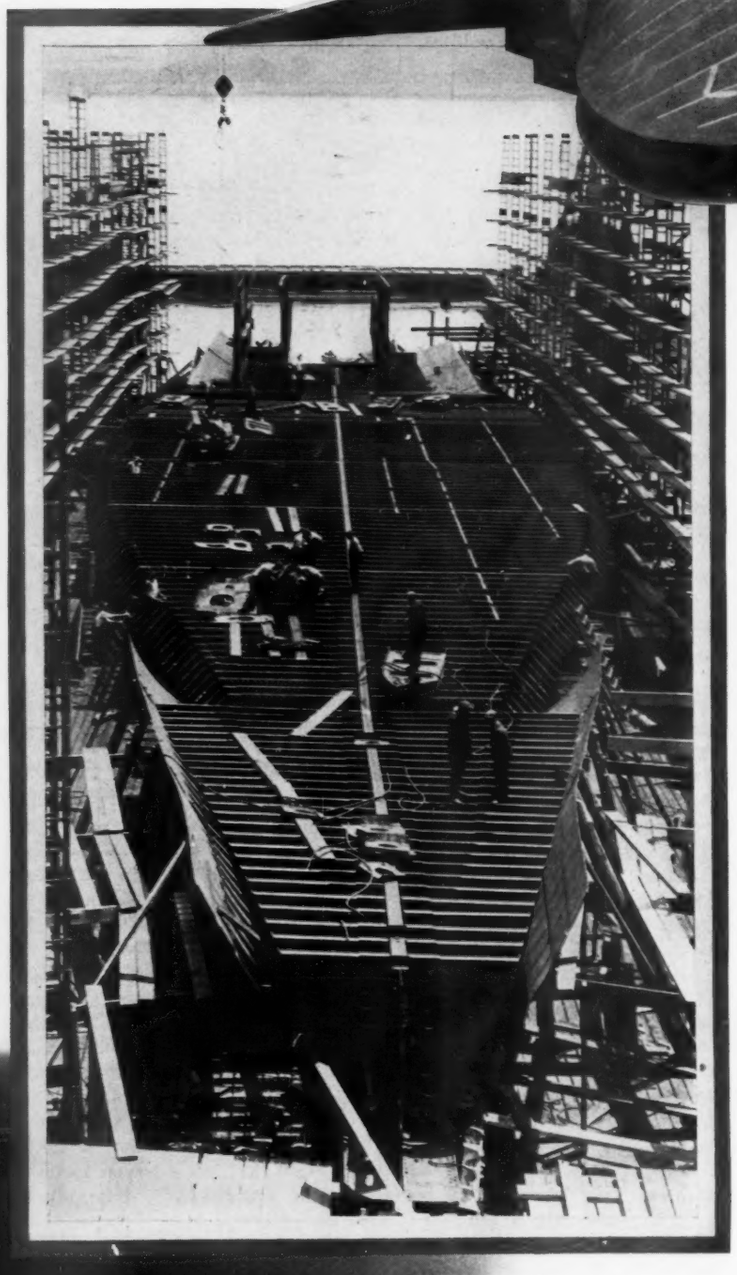
GETTING CLOSE TO THE SOIL

IN THESE times, a surprisingly large number of persons are finding out what makes the garden grow. No longer do we poke fun at the perspiring commuter who dashes for the five-fifteen burdened down with rake, hoe, spray tank, and other impedimenta that typify the quasi-ruralite. Rather do we envy him for, like as not, we also have our little plot of green-growing things that we watch over with tender care; and we enthuse as much about a new tilling tool as we once did over an additional gadget for the garage. Many a man is finding out that a hoe requires a far different swing than a golf club, but that in the long run it is capable of yielding even more health-giving, outdoor exercise.

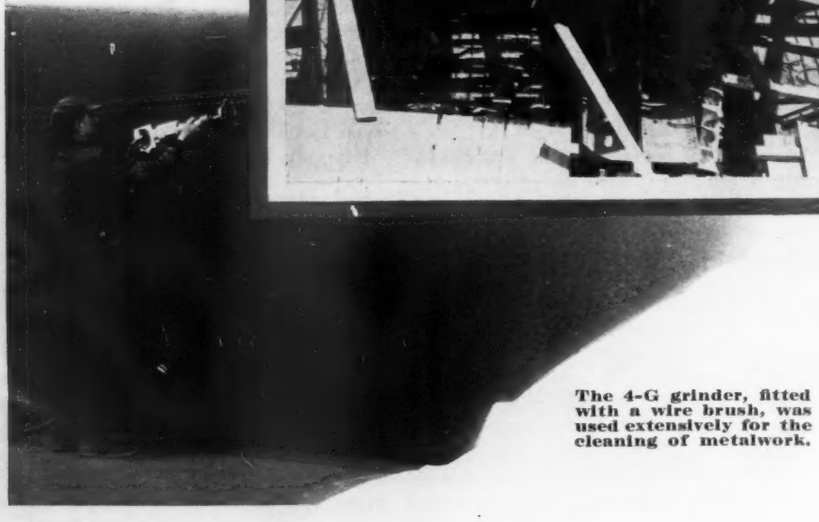
Happily, there is no depression in Nature. Foodstuffs are growing just as spiritedly in 1932 as they did in 1929. For those who must eat, but whose pocketbooks are a bit thin, this is proving a distinct boon. Subsistence gardens have sprung up throughout the land, and industrial workers tending them are becoming as adept as truck gardeners. Surplus corporation properties are being put to gainful use and are "growing" better feeling between employers and employed at the same time that they are producing edibles for dining-room tables. In this issue we give a brief account of one such community undertaking.



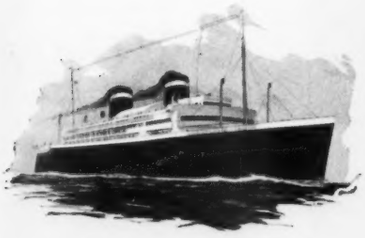
Surfacing the blades of a propeller with a 4-G grinder to secure the delicate balance needed.



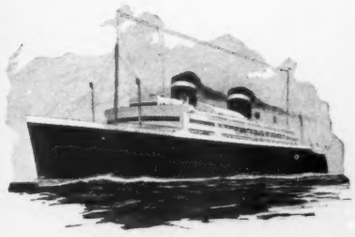
The steel substructure of one of the new liners. The picture conveys a good idea of the staunchness that is built into these modern ships to fit them to carry on against wind and wave.



The 4-G grinder, fitted with a wire brush, was used extensively for the cleaning of metalwork.



Courtesy Grace Line
The "Santa Clara", one of the fine fleet of Grace Line boats, in New York Harbor.



Four Fine New Ships for the Grace Line

These Speedy Craft are for Passenger and Freight Service Between New York and San Francisco via the Panama Canal

R. G. SKERRETT

IN THE glamorous days when Old Spain dominated the seas, her craft frequently bore the names of saints to whom the owners looked for protection when their vessels ventured upon the open ocean and faced the hazards they knew full well lurked there in sudden storm and angry wave.

In that remote era ships were propelled by the free winds of heaven, to which the navigators trimmed their sails so skillfully that the boats could be driven upon the desired courses. Looking backward, we realize that those ancient craft were relatively primitive in their outfitting; and life aboard of them was never an easy one even when wind and weather favored. So much for the past.

Today, The Grace Line has under construction four beautiful steamships, representing in their manifold departments everything that the naval architect, the marine engineer, and contributors in numerous fields of manufacture can make them. When any of this squadron shall head seaward, the commanding officer on the bridge will be conscious of the independence that is his. Power developed in the bowels of the ship—not the sweep of the wind—will carry him onward under all states of the weather and at speeds undreamed of in the days of the caravels and the galleons. While she is making her distant ports on schedule, life aboard will be pleasant, comfortable, and even beguiling. The four ships, as did those of bygone centuries, will bear the names of saints—*Santa Rosa, Santa Paula, Santa Lucia,* and *Santa Elena*—all colorful and befitting. Thus tradition and modernity will go hand in hand across the waters of the Spanish Main and in touching at places that are historically interesting because of the doings of the *conquistadores* and the romance of the days of their successors.

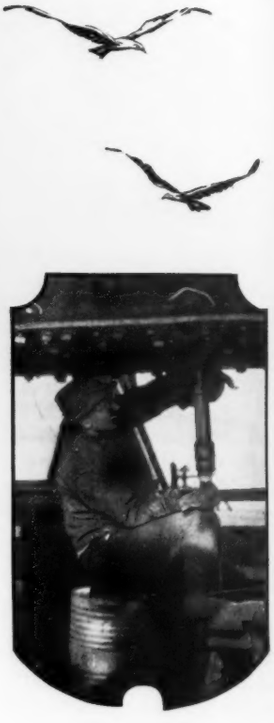
Even though steam will give the new vessels a full measure of self-sufficiency in storm or sunshine, still we wonder if the names chosen for them do not indicate the source of the courage that inspired the officials of The Grace Line to go ahead with the building of four such splendid craft notwithstanding the clouds of a widespread depression. Be this as it may, there is no denying that stoutness of heart, determination, and farsightedness were needed in carrying forward a venture that will entail a total obligation of about $19,000,000. This material evidence of faith in America's future should have a tonic effect upon hesitators in other fields of endeavor.

The *Santa Rosa* was launched on March 24 from the yard of the Federal Shipbuilding & Dry Dock Company, at Kearny, N. J.; and the second of the flotilla, the *Santa Paula,* was put into the water at the same plant on June 11, just past. The remaining vessels will be overboard by the end of the year, before which time the *Santa Rosa* will have started upon her maiden voyage. The *Santa Rosa* and her sister ships are building under the Merchant Marine Act of 1928. That wise bill was designed to grant loans at low rates for the purpose of stimulating the construction of modern competitive merchant craft fabricated of domestic marine matériel in American shipyards and owned and operated by American citizens. As a further inducement to such of our enterprising citizens, the Post Office Department is authorized by the same legislation to enter into long-term contracts, under favorable conditions to the operators, for the carrying of mails to foreign countries. In short, the aim is to enable American merchant ships to compete with those of other nations without sacrificing our accepted standards of living. As President Hoover wrote at the time of the launching of the *Santa Rosa:* "With the aid provided by mail contracts and construction loans, authorized by this Act, orders have been placed for 45 new vessels of 500,000 gross tons and for the reconditioning of 19 vessels of 160,000 gross tons." Before the operative period of the Merchant Marine Act of 1928 ends, the Stars and Stripes will fly, because of it, on 125 new and modernized vessels representing an aggregate of 1,000,000 gross tons. Our shipyards, a great many other allied industrial plants, and many thousands of workers have been and will continue to be gainfully employed because of this beneficial legislation. A boon at any time, and especially so today.

The constant volume of new construction

Fairchild Aerial Surveys, Inc., New York City

Tugs nosing the "Santa Rosa" around to the fitting-out slip just after launching at the yard of the Federal Shipbuilding & Dry Dock Company.



Riveting the shoe plate to the keel.

thus made possible has created a particularly fortunate situation in this country: it has given our naval architects, our marine engineers, and our shipbuilders the stimulus and the opportunity for research along many lines contributive to betterment. The *Santa Rosa* and her sister ships reflect this in their designs, in their mechanical equipment, and in all their appointments and fittings that will affect the comfort and convenience of their patrons: and the high performances that can be confidently counted upon will be of advantage to shippers as well as to the operators. The country as a whole will gain through the influence these boats will exert wherever they touch; and the nation will be so much better off because of these vessels if an emergency arise in which they can be employed for naval or military purposes.

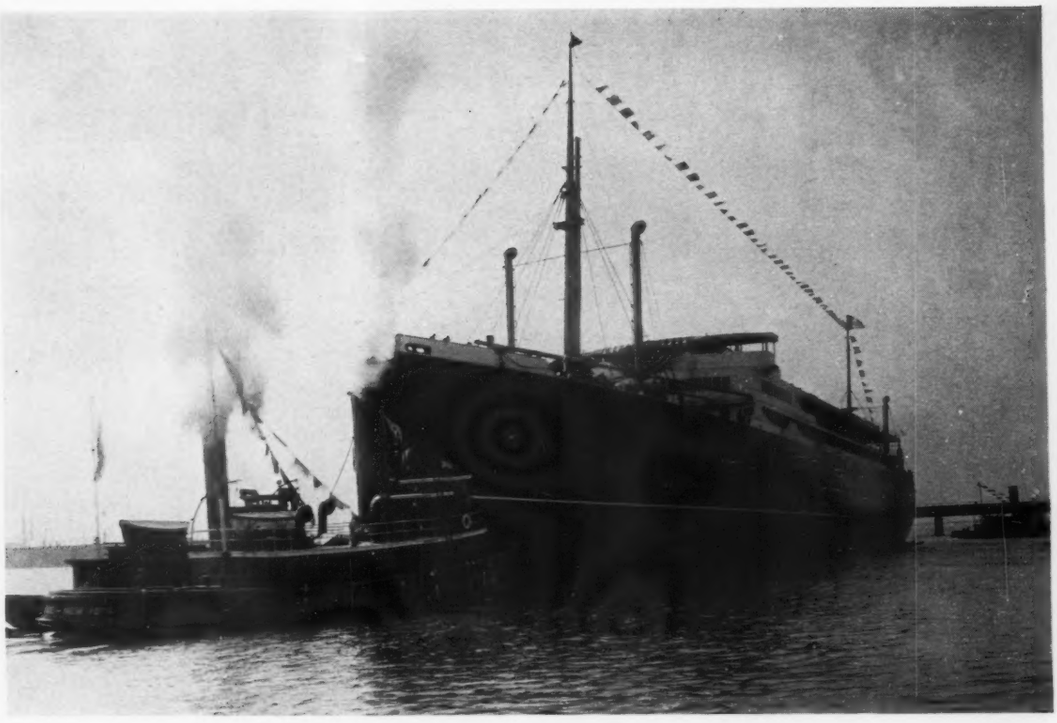
The *Santa Rosa* and her sister craft are alike in every essential particular; and in adding them to The Grace Line fleet the object is to maintain fortnightly sailings, in each direction, between New York City and San Francisco and to make intermediate ports in both South and Central America. By reason of their long experience, the owners entertained in advance of designing very definite views concerning the size, the speed, the cargo space, and the passenger facilities which the ships should have to maintain that standard of service which is characteristic of Grace liners. These requirements called for a maximum of space for the public social activities of passengers, and they also specified that unusually large and attractive staterooms should be provided for the somewhat limited number of patrons that each vessel was to accommodate. The final details were arrived at only after a series of conferences between the officials of The Grace Line and the well-known firm of naval architects, Messrs. Gibbs & Cox. With these preliminaries disposed of, covering as they did the general design features, then models of the hulls were built and run at various speeds in the Government Model Experimental Basin at the Navy Yard, Washington, D. C. Those tests revealed what details of form should be adopted to insure the ships performing satisfactorily at different speeds and under various conditions of loading. This procedure is interesting because it shows what steps were taken to be scientifically sure that the four sister craft would be notable additions to the nation's fleet of combined passenger and cargo carriers.

Inasmuch as the ships will operate both in the tropics and in the temperate zone, passenger accommodations were planned so that they would provide an abundance of light and a free circulation of air and yet, in cold weather, be susceptible of proper heating and ventilating. This has been done, and the vessels will be comfortable at any season. The main public rooms are all on the promenade deck, with a lounge forward, a private dining room and a library abreast the boiler hatch, the main dining saloon amidships, a small dining room alongside the engine hatch, and a café aft. The main dining saloon is two decks in height, with large windows on the sides, and is surmounted by an arched roof which is made of sliding sections that can be shoved aside in fair and mild weather to permit dining with the sky in sight. Each craft will have accommodations for 222 first-class passengers.

By swinging wide the folding doors on the after side of the café, passengers can sit beneath an awninged veranda that overlooks the swimming pool on the deck below. This tiled pool, about 20 feet wide and 35 feet long, is said to be the largest outdoor pool on any ship in service; and this feature is counted upon to be a popular one. All food for the travelers will be cooked in a galley situated way aft and up on the boat deck, an arrangement that will keep the heat and odors of cooking from the passenger spaces. The staterooms are on the bridge and the upper decks, and all are outside rooms. Those on the bridge deck are set far enough back from the ship's side so that windows can be kept open even under severe weather conditions. Every first-class stateroom has a private bath or shower—an innovation in which these four new boats of The Grace Line lead the world. The vessels are distinctive in other ways—all of which are indicative of the efforts made by the owners and operators to give pleasure to their patrons and to insure their comfort continually.

Because the routes to be followed by the ships on their eastward and westward runs will include a number of stops for the discharge and the taking aboard of cargo and passengers, much thought was given to making the hold spaces readily accessible so as to facilitate the handling of freight. This included the providing and the placing of winches and associate equipment for the rapid

CSA drill reaming rivet holes.



The "Santa Rosa" immediately after launching. This was the first of the four ships now under construction to be put on the building blocks.

and easy movement of incoming and outgoing cargo. By reason of this foresight, the time required for disposing of freight while in port will, undoubtedly, be considerably shorter than that normally needed for such work. For the benefit of the passengers, the cargo-handling gear will be nearly noiseless. To this end the electric winches will be operated by worm drive. A heavy lift derrick on each ship will make it practicable to hoist and to lower single loads weighing up to 50 tons. In addition to the extensive cold-storage space for foodstuffs, etc., each vessel has a refrigerated-cargo capacity of about 42,000 cubic feet. A large space between decks is arranged for the carriage of uncrated automobiles. This will enable passengers to take along their cars without going to the extra expense of having them specially packed.

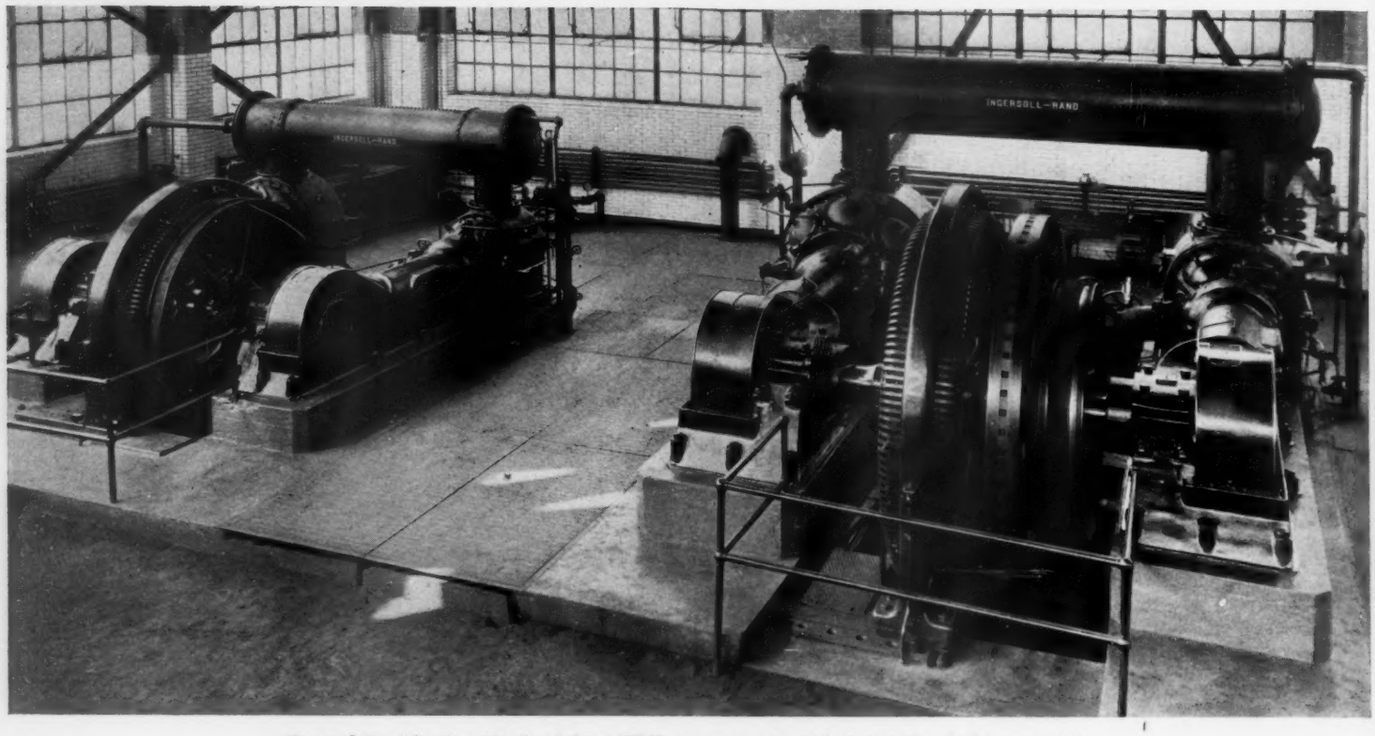
The builders of the four liners are required, under their contract, to guarantee a maximum trial speed on a specified developed horsepower and a fixed consumption of fuel. These three interrelated factors—all closely calculated—rest upon data obtained by the towing experiments in the model basin; and in the last analysis are reflected in the main power plant. That is to say, the boilers and engines were designed with an eye to limiting weight and saving space. Two turbine units, fitted with reduction gears, will drive the twin screws, and are intended to operate at high efficiency but with liberal factors of safety that are counted upon to insure their upkeep with a minimum of overhaul and expense. Despite their compactness, the turbines will be readily accessible for repair or inspection.

The boilers, the primary source of motive energy, represent a marked departure in marine practice. These steam generators embody certain features that have been proved of value in central power stations on land. The boilers will be fired with fuel oil; and the burners are spaced so as to prevent their flames from impinging directly upon heating surfaces or brickwork within the furnaces. Furthermore, the side walls of the furnaces are fitted with water wall tubes—the arrangement being such that a high combustion efficiency is combined with an unusually long life for the furnace walls. In addition to the foregoing provisions, interdeck superheaters and economizers will serve to raise the steam to the required temperature and, at the same time, insure the heating gases leaving the boilers at the lowest practicable temperature. That is to say, as much as possible of the effective heat of the gases, produced by the burning fuel, will be absorbed in generating steam and providing power before those gases are delivered to the uptakes of the smokestacks. This is just one more example of the skill exercised by the marine engineers responsible for the power plants of these four fine ships.

Each of the liners will have an overall length of 508 feet, a maximum beam of 72 feet, and will draw 26 feet of water at her load line. The displacement, when ready for sea and carrying the designed load, will be about 16,500 tons; and the propelling machinery, when developing 12,500 hp., will be able to drive the craft at a speed of approximately 19 knots an hour. This power capacity and this sea speed are counted upon to enable the liners to maintain their schedules and to permit them to touch, en route, at seven foreign ports in making their runs to and fro between San Francisco and New York.

The plant of the Federal Shipbuilding & Dry Dock Company was organized in 1917; and work on wartime vessels was actually started before the yard was thoroughly equipped. At the peak of operations there were twelve building slips in service: today the plant is rated as a 6-shipway yard. The establishment has been maintained in an up-to-date and efficient manner ever since the years of armed conflict, and was, therefore, able to contract for the four Grace liners with the guarantee of rapid and first-class work.

The Magazine is particularly interested in the present undertakings because of the uses to which compressed air is put in constructing the vessels. Many, many thousands of rivets are driven in assembling each ship on her building way. The rivet holes are reamed and countersunk with piston-type air drills, and the rivets are driven with air-operated riveting hammers. Certain structural parts are fabricated in the shop, and some of this work is done with bull riveters, which are also actuated with compressed air. In the plate shop, one big planer is equipped with a multiplicity of jacks that press down upon a plate and hold it securely while being machined; and all these jacks are functioned pneumatically. Forging hammers, plate heating furnaces, etc., are operated by compressed air. Chippers and calkers, both in the shop and on the building ships, are pneumatic tools; and so are the wire brushes and grinders that are



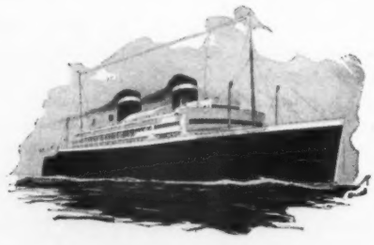
Two of the big electrically driven PRE compressors which supply air for a multiplicity of services in the yard of the Federal Shipbuilding & Dry Dock Company.

used for removing scale on steelwork and for truing surfaces. Glowing rivets are shot from the forges through pneumatic passes, metal hose carrying the rivets to points in the growing ship that could not be reached quickly and safely if the rivets were relayed by hand.

The priming coat on woodwork and on the surfaces of much of the steelwork within the vessels is spray painted; and in the insulated cargo spaces linings of granulated cork, as much as 10 inches in thickness, are blown into place and massed under the impulse of compressed air. Because no steam is used in the yard—electric drive being depended upon generally—winches at the dock and winches on the ships are air operated. The pumps required to get water out of the vessels while under construction are also air operated; and steel sheet piling, forming watertight bulkheads around the outer ends of the shipways before the craft are launched, are driven into the river bed with large pneumatic hammers designed for work of that kind. Because of this widespread and extensive employment of compressed air, there is a distributing system that reaches from the compressor plant to every part of the shipyard where this motive medium is needed. A battery of five large electrically driven units provides the necessary air, and two of these are commonly sufficient to maintain the working supply. Before finishing with the uses to which compressed air is put in the yard, mention should be made of the fire-protection sprinkler system installed in the plant. It is what is known as a "dry system"—that is, the pipe lines are charged with air to keep out the water which might freeze and cause trouble in cold weather. When the heat is high enough to melt the sprinkler fuses, the compressed air escapes, freeing the water so that it can flow to the discharge points.

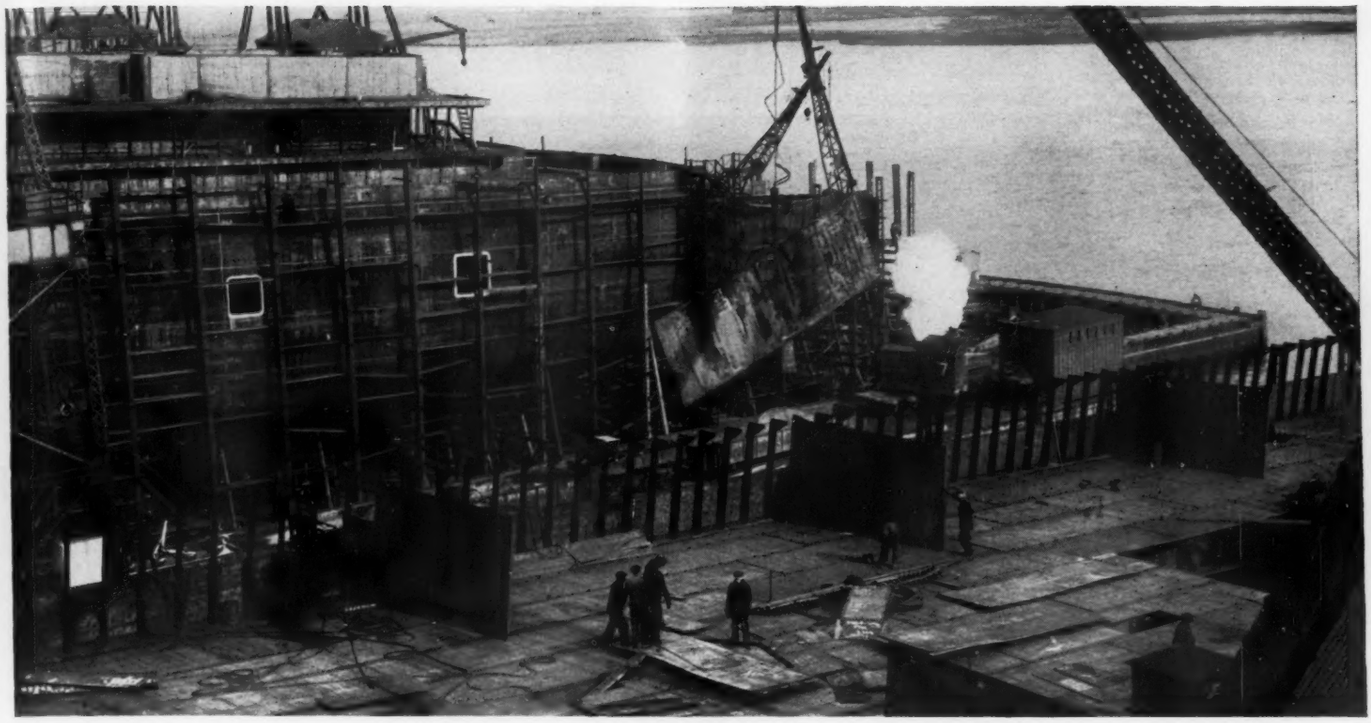
Beyond question, the most spectacular moment in a ship's career is that of her launching. Then it is that her towering mass, which has progressively increased in bulk and weight, is transferred from the land to the water. Even to the uninitiated, the act is thrilling, because the ship seems suddenly to be inspired with life and to move eagerly toward the element upon which she was designed to float and to travel. But how many of the spectators are aware of the long preparations which have led up to that climax—preparations that must be carried out with care and thoroughness at every step lest the picturesque spectacle become an occasion of disappointment if not one of disaster?

The launching weight of the *Santa Rosa* and the *Santa Paula* was, in each case, 7,000 tons; and so that each could be put overboard safely, proper provisions had to be made for the craft's support while building. This was done in advance of laying her keel by driving more or less closely spaced piles deep into the shore and as far out into the water as the vessel was to be supported not only during construction but when sliding toward the water and not entirely sustained by that fluid. With the ground thus stabilized, then there was placed the spaced line of blocks, with their tops on a prescribed slope waterward, upon which were to be laid the keel plates to which would be secured the vertical keel or backbone of the structure. Any sagging of the keel blocks later might lead to deformation of the hull and induce structural weaknesses that might be aggravated at launching and cause serious consequences at that time. Assuming that every precaution has been taken to prevent sagging of the keel blocks, and that all work has gone forward as it should up to the actual preparations for launching, let us see how that operation is made possible.



Without going into technical details, we shall confine our description to the broad essential features of the launching apparatus. Beneath the ship, on each side of the building blocks, there is laid in line—slanting toward the water and reaching into it for a distance—a series of broad and heavy timbers, nicely fitted together, and resting on a suitable foundation of crosswise timbers set up at regular and close intervals. In this manner are laid what are known as the ground ways—really broad tracks which at the proper time are heavily coated with a suitable lubricant, a greasy compound. Bolted along the outer edge of each ground way and projecting above it is a continuous ribband of oak planking. These ribbands serve to keep the launching ways from sliding laterally while the ship is descending and moving toward and on to the water.

Upon the ground ways are laid the two sliding ways each of which is composed of a

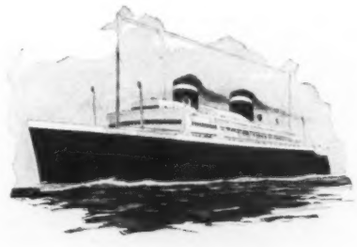


Photo, Drix Duryea

Two of the new Grace liners rapidly taking their intended forms as plates, angles, and structural steel parts of all kinds are bound together with innumerable rivets.

series of broad and heavy timbers bound together so that they will move as a unit when the vessel is released at launching. Between two of the longitudinal courses of these timbers are inserted at close intervals numerous white-oak wedges; and at certain points, forward and aft, a cradle is built up higher to conform to the curved body of the ship. Elsewhere, other suitable timbers are placed to give still greater support to the hull when the steadying shores used during construction are knocked away just before launching. The purpose of the hundreds of wedges along the outer side of the sliding ways is, at the right moment, to lift the craft sufficiently off the keel or building blocks so that they can be removed preparatory to putting her overboard.

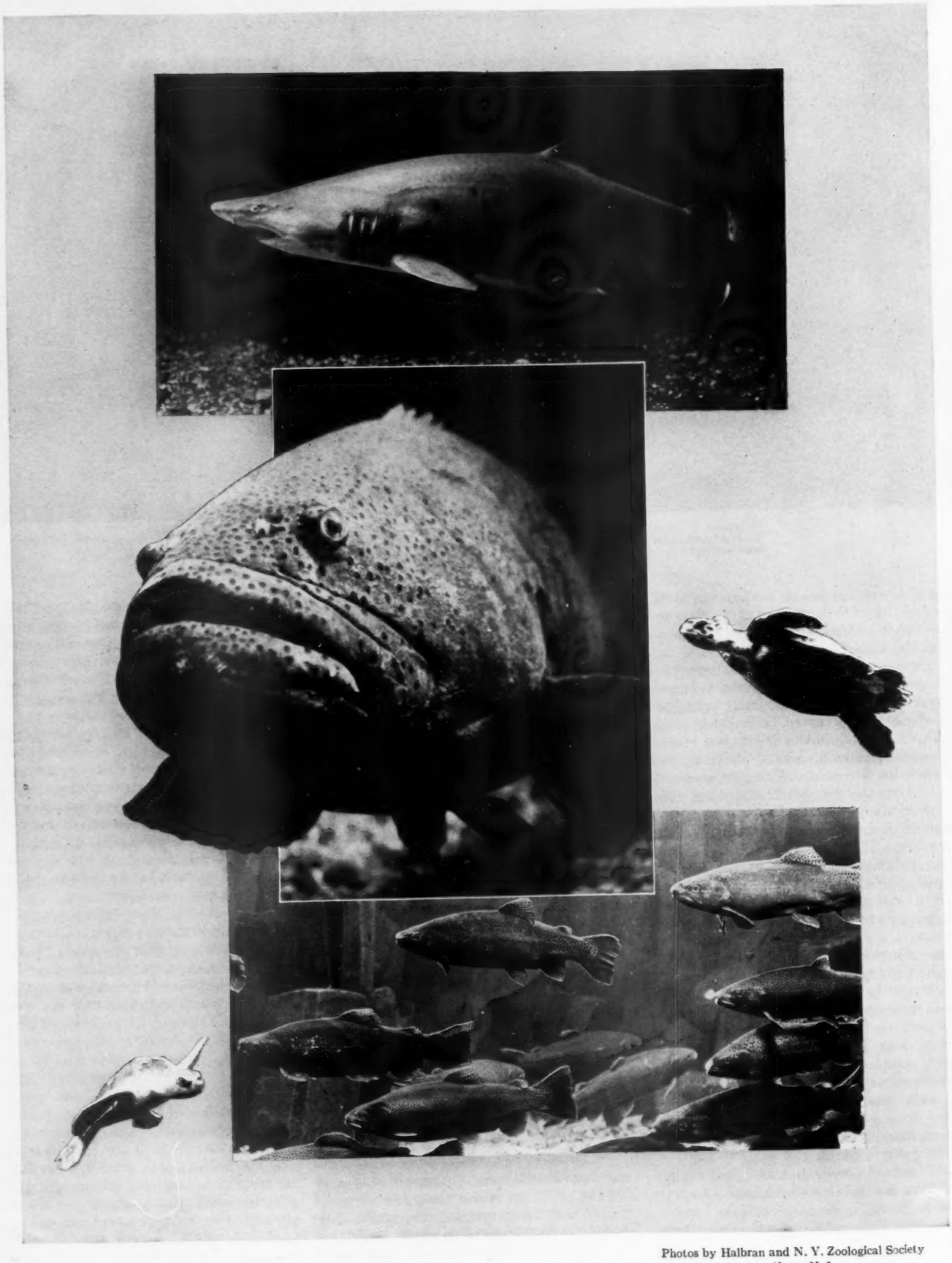
Beginning at the stern or waterward end of the ways, the wedges are driven successively farther in between the gripping timbers. This is done with battering rams of hardwood; and each ram is swung by a couple of men. The wedging proceeds according to schedule; and each wedge is driven a prescribed distance. In this fashion the 7,000 tons of the ship's dead weight is raised and transferred from the building blocks to the ground ways and the superposed sliding ways, cradle, etc. When this operation has been completed, the craft is kept from moving toward the water by a powerful trigger arrangement that locks the forward end of each side of the sliding ways. The trigger is held in position by the pressure of a hydraulically operated plunger. At the chosen moment, this pressure is released, the trigger is tripped by the vessel's pull, and then, after an instant of hesitation and a quiver throughout her whole body, she starts toward the water, gathering momentum as she descends—her final speed of translation depending upon the slant given the ground ways which provide support up to the time when the bow, with a graceful dip, is water borne.



Because the channel of the Hackensack River is not as broad as the stream appears, it is necessary to halt the ship shortly after she is afloat so that she will not be carried too far out and across into shallow water where she would ground. Therefore, she is snubbed or checked in her triumphant sweep by four heavy hawsers that are secured to her and also to twenty blocks of concrete weighing 9,000 pounds apiece. Each hawser is tied to five of these 4-foot cubes, spaced like enormous beads 30 feet apart. They are dropped in the river, two groups on each side of the path to be taken by the vessel; and when the hawsers tauten as the ship advances, the craft progressively drags upon more and more of the blocks. In this manner her travel is checked and finally arrested before she gets beyond the width of the channel. Then it is that the tugs standing by hasten to the vessel and work her around and alongside the outfitting dock. Not until then do her builders breathe with full relief.

The four new "Santa Ships", as they are familiarly called, mark the present climax of sea-borne traffic under the management of the House of Grace. Fully three quarters of a century ago, William Russell Grace, the founder of W. R. Grace & Company, began the promotion of trade between the continents of the Western Hemisphere. In those days of clipper ships—the heyday of the windjammer, towering expanses of canvas were counted upon to carry the craft on their way; and the interocean voyage necessitated the rounding of Cape Horn where sudden and violent storms, high seas, and battling head winds so often taxed to the utmost the mariner's resourcefulness. Despite those handicaps and recurrent hazards, The Grace Company held on, fostering the while cordial relations between the peoples of the two continents and winning, at the same time, well-deserved esteem and material rewards. This record of long and fine service forms an enviable historical background for the typically modern and efficient fleet of The Grace Line.

A simple and effective method of accelerating the cooling of bars of alloy and high-carbon tool steel undergoing heat treatment is being used in an eastern steel plant. The electric heat-treating furnace in service has a capacity of 50 tons of bar stock 25 feet long, and has a removable cover that extends its full length. Across the underside of this cover have been run pipes made of a heat-resisting alloy, and these pipes are connected with a blower-air system. The air that is thus forced through the piping extracts heat from the furnace chamber, inducing, so it is said, comparatively rapid cooling without causing excessive oxidation of the charge.



Photos by Halbran and N. Y. Zoological Society

Top—A shark, with two shark suckers attached to its underside by means of a suction disk on top of the head. They are towed by the shark and live on food that escapes its mouth. Center—A 300-pound junefish. Bottom—Rainbow trout in a tank lined with columnar basalt.

Backstage in a Large Aquarium

Extensive Equipment Safeguards Health of 5,000 Tenants in New York Institution

C. H. VIVIAN

IT IS a safe assumption that the majority of homes in the United States have at one time or another contained a bowl of goldfish. Of recent years it has also become quite the popular thing to keep an aquarium of tropical toy fishes. Streams, lakes, and the oceans lure increasingly greater numbers of anglers each year. All in all, there can be little doubt that the average American is interested in fishes.

Public aquariums are among the most favored visiting places in the larger cities. They present a living, moving, colorful panorama that is alike interesting and educational. It fascinates children and adults of both sexes. The New York Aquarium, with which this article is concerned, often draws more than 20,000 persons on a Sunday afternoon. During the 35 years of its existence, it has had well over 60,000,000 visitors.

But, while thousands of people are acquainted with what aquariums have to display, comparatively few have ever looked behind the scenes to see what is involved in keeping such institutions going. To have that privilege is to realize that not all the interesting things are out in front, and to become aware that varied and extensive human and mechanical agencies are required to provide and maintain the exhibits. The successful administration of the New York Aquarium calls for a staff having diversified qualifications. Its members not only must know thoroughly the habits, characteristics, and peculiarities of their aquatic charges but must also be of a mechanical turn of mind and have a bent for devising ways and means of meeting perplexing problems which arise without warning from time to time. The physical plant, which is under the supervision of a chief engineer, includes a wide variety of mechanisms, appliances, and fittings. Among these are an air compressor and other means for introducing into the water a plentiful supply of life-giving oxygen.

If the fishes and other aquatic forms are to thrive, their native habitats must be reproduced or closely approximated. As the specimens are obtained from far and near, from northern latitudes and from the tropics, it is obvious that a wide range of living conditions must be established and maintained. Each species must be given the environment to which it has been accustomed, and must be provided with the food that best meets its taste and requirements. It is the same as though one were to assemble people from all over the earth and attempt to give them the climate, food, and living conditions they had been used to.

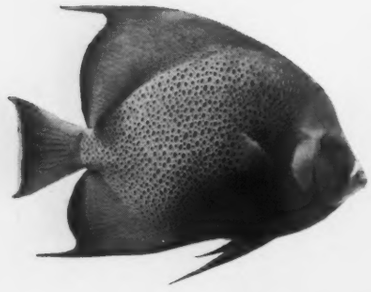
Halbran Photo

Charley Penguin, who died of loneliness. After his mate had passed on, aquarium attendants tricked Charley for a time with a mirror. But he learned that his image was not alive and lost interest in life.

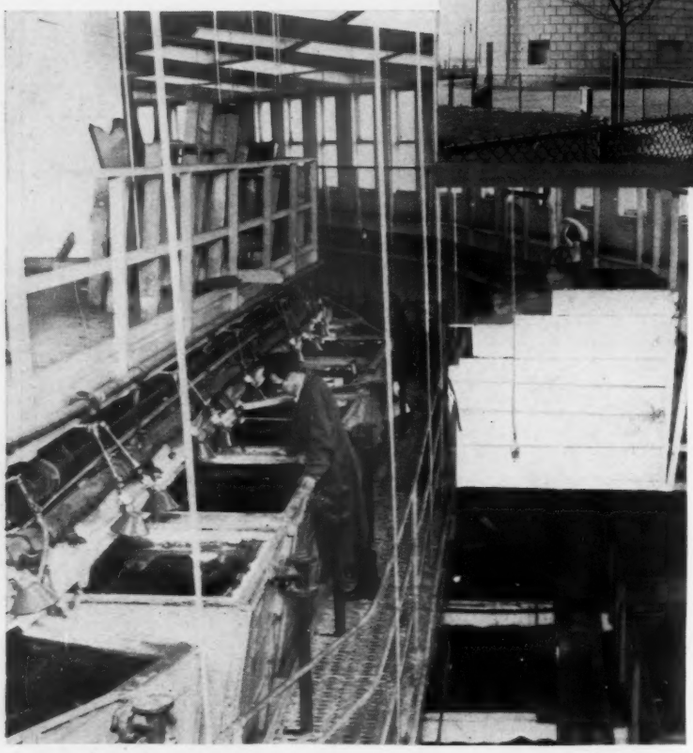
So far as aquariums are concerned, this has never yet been fully accomplished. In fact, although there are more than 40 aquariums open to the public throughout the world, besides numerous others that are conducted as business enterprises or for scientific purposes, we have it on the word of Dr. Charles H. Townsend, director of the New York Aquarium, that "the completely equipped aquarium has not yet been planned." Nevertheless, the New York institution has gone far towards providing its normal population of 5,000 with comfortable and healthful surroundings. This statement is borne out by records showing the length of time some of the specimens have survived there in captivity. Garfish, mudfish, and striped bass have been kept for a quarter-century and longer. A sea lion frolicked in a floor pool for nineteen years. Sunfish, rock bass, calico bass, and perch have rounded out a dozen years or more. A 200-pound junefish and a nurse shark each lived more than nine years. Incidentally, the more active creatures live longer than the sluggish ones, which may be something for human beings to think about.

Foremost among the needs of the aquatic tenants is an adequate supply of water. Broadly speaking, only two kinds are required—sea water and fresh water; but as there are both northern and tropical freshwater and marine species to satisfy, the same temperature will not do for all. As a result, some seven or eight different water conditions must be maintained.

Two varieties of sea water are provided. A supply of high purity is obtained by boat



N. Y. Zoological Society Photo



Halbran Photo

Above—The New York Aquarium in Battery Park. A century ago the building was a fort.

Left—Section of service passageway behind and above the exhibition tanks.

about twenty miles out from the shore, beyond the zone of pollution. This is stored in an underground concrete reservoir of 100,000 gallons capacity adjacent to the aquarium. It is covered and kept dark to prevent the formation of algae. The original supply of water received in 1908 was used for nineteen years, with only such additions as were necessary to replenish losses through evaporation, leakage, etc. Such an extended period of usage is made possible by continuous filtration of the water as it circulates through a closed system between the reservoir and display tanks. The reservoir has four compartments. These are connected in series of two each; and the supply for the tanks is drawn from a different section from that receiving the return water, thus facilitating settling. As three of the reservoir divisions can hold the quantity of water in storage, each section can be cleaned in turn as this becomes necessary.

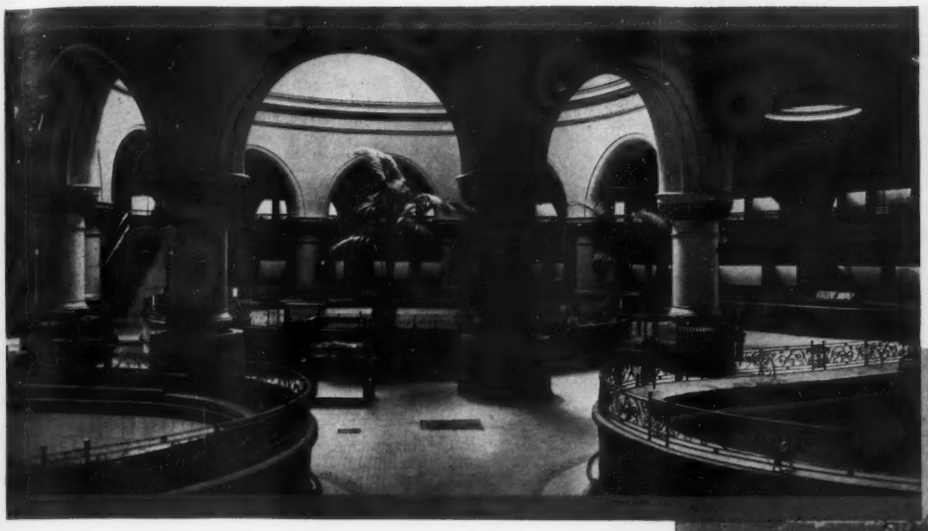
Bay water, which suffices for some of the floor pools containing such forms as sea turtles and sea birds, is obtained from two wells driven beneath the building, which was originally several hundred feet from the shore line of Manhattan Island as it then existed. This water is brackish and contains impurities which make it unsuitable for most of the marine fishes. It is filtered before use; but as the supply is plentiful, the overflow from the pools is allowed to run to the sewer. Fresh water is secured from the city taps. To improve its clarity, it is filtered before going to the tanks. Some of it does double duty—the discharge from the tanks in the gallery flowing to reserve tanks.

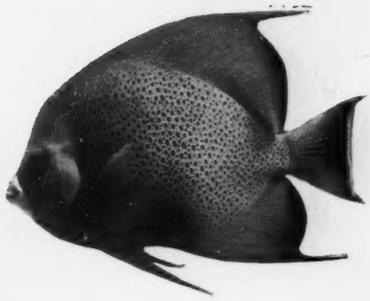
Motor-driven centrifugal pumps draw sea water from storage and bay water from the wells through 4-inch pipe lines and deliver it to separate wooden tanks placed high enough to provide for gravity flow to the display tanks. Because of the corrosive action of the saline water, the intake ends of the pumps are of admiralty bronze. Pumping units for this and for other purposes are installed in duplicate, and there are, in all, eight pumps. To be serviceable, piping to handle sea water must be of special material. Lead-lined pipes run between the reservoir and the overhead tanks, while galvanized pipes transport the bay water. Portions of the system which distributes sea water from the overhead tanks to the display tanks are of hard rubber and 4 inches in diameter. Iron pipes, connected with rubber couplings, were formerly employed for this service. Lead pipe is suitable for all salt-water aquarium lines, but its use is usually limited because of the cost.

During the winter months, the sea water for the tanks containing tropical fishes is kept at a temperature of 72° F. by heating it by means of a lead-pipe coil placed in the bottom of a distributing tank and supplied with steam at 5 pounds average pressure. Pond turtles and alligators will not eat heartily in cold weather unless they are warm, so the fresh water for them is heated by a bronze-pipe coil through which steam is directed. A temperature of about 85° F. is maintained for alligators and crocodiles, and one of 75° F. for turtles. Lung-breathing marine animals such as sea turtles, porpoises, sea lions, and sea birds commonly go south in the winter, and when they are deprived of such migration they must be provided with water of at least 60° to 65° temperature. This is accomplished with a coil heater. To cool some of the fresh water used for trout in the summer time, there is a refrigeration plant which operates on the direct-expansion system. A 2-stage, electrically driven ammonia compressor has a daily refrigerating capacity of 15 tons.

The display tanks, numbering more than 90, are arranged end to end in rows. Sides and back of each are of masonry or wood, lined with concrete laid on wire lath. The front is of polished plate glass of a thickness which varies from 1 to 1¼ inches, according to the area. Tanks are lighted by diffused daylight from ample glass overhead and also by electric lights, placed above their open tops, which are obscured from the vision of the spectator.

To simulate natural surroundings and to vary the appearance of the tanks, some of them are lined with stonework. Coral, calcareous tufa, conglomerate, and other ma-





N. Y. Zoological Society Photo

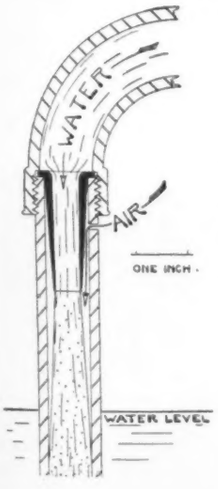
Above — Interior of New York Aquarium, which is maintained by the city and managed by the New York Zoological Society.

Right—Chef preparing a meal. The feeding of the collection involves much labor and expense.

Halbran Photo

terials are used, care being taken to place them so that they will look well and leave openings and grottoes which the fishes find of interest. Sand is placed in a corner of the tanks, it having been found beneficial to many of the forms. Fresh-water turtles, and certain fishes such as flounders and skates, like to bury themselves in the sand. Many fishes brush against the abrasive, apparently to rid themselves of bothersome organisms, and others, such as angel and butterfly fishes, have a habit of cleansing their gills by blowing through them sand that has been taken into the mouth. In addition to the larger display tanks just described, there are 73 tanks for tropical toy fishes and seven large floor pools.

Aeration of the water is of great importance. Most fishes will be more healthful, will grow faster and live longer, and greater numbers can be kept in a given quantity of water if they are plentifully supplied with air. Various means are adopted to meet this requirement. Sea water and bay water enter the overhead distribution tanks over baffles which impart to them a tumbling motion similar to that which takes place in rapidly moving streams, thus enabling them to take up considerable atmospheric air. Water supply lines to the display tanks are carried downward so as to discharge underwater, close to the bottoms. Just above the point where it enters the water, each pipe is perforated, and inside of it there is a 2-inch length of smaller, tapered pipe, as illustrated in one of the accompanying cuts. The rush of the water through this interior pipe section tends to draw air through the opening in the outer pipe and to carry it downward to the discharge end. The water-jet effect produced by the inserted pipe serves to break up the air into small bubbles which emerge in the tank in the form of a fine mist.



Water-jet aerator

Compressed air is not normally required in the tanks, but is used in times of emergency when, for some reason, the water cannot be circulated and aerated in the usual manner. It also is employed during the cleaning of the filters, which generally takes place twice weekly, although the filters are constructed in two sections, thus making it possible for one half temporarily to handle the full water load while the other half is being cleaned. Compressed air likewise proves helpful where there is overcrowding of fishes in a tank, or where it is desired to stimulate the growth of certain forms. There is a compressed-air connection for every tank, and the total of air piping in the building approaches half a mile. Air pipes enter each tank at the top and extend down nearly to the bottom, close to one side. To break up the air stream into small bubbles of mist-like consistency, it is discharged through a piece of carborundum which is soldered into the end of the pipe.

The air compressor is a motor-driven machine. It discharges at a pressure of 21 pounds to the square inch, and the air reaches the tanks at about 20 pounds pressure. The compressor intake was formerly located in the basement near the unit, but it was found to take in considerable quantities of hydrogen-sulphide gas which got into the building with the bay water and which settled to the lower levels because of its greater weight than air. When circulated it caused acidity of the water, which was harmful to the fishes. Accordingly, the intake was changed to a point well above the ground on the outside of the building. Intake air is cleansed and purified by passing it through water in a filter of special design.

In addition to its use for aeration, compressed air performs another very important service in the cleaning of the filters for sea water. These filters consist of two adjoining concrete boxes, each 10 feet long and 6 feet wide, which are filled to a depth of 2 feet with quartz sand. Half embedded in the floor of each compartment are closely laid rows of

N. Y. Zoological Society Photo

Hand-operated air compressor which is used in the aeration of shipping tanks.

1½-inch lead pipe, the exposed upper surfaces of which are cut across by numerous openings made with a 1/32-inch saw blade. Water returns from the exhibition tanks through a 4-inch pipe which has discharge openings on top of the section which runs across and above the filters. It percolates through the sand, enters the small lead gathering pipes at the bottom, and these, in turn, feed into a 4-inch header laid transversely to them in the center. To facilitate cleaning, four finely perforated compressed-air lines are laid across the bottom of each compartment. To clean a filter, the inflowing water is shut off and, after the compartment has drained, fresh water is admitted at the bottom through the pipes which normally receive the filtered water. At the same time, compressed air is turned on. The combined action of the air and water serves to stir up the sand and to carry waste matter to the top, where it drains off into the sewer. Further agitation by compressed air is effected by means of an air jet, a workman inserting a long pipe into the sand bed and thoroughly stirring it.

Special means of aeration are adopted at times. One of these is used on warm summer days for the purpose of cooling and aerating the water containing such fishes as trout, salmon, and whitefish. Three 1-inch pipes are laid across the top of the tanks about a foot above the water level. These discharge water through perforations in their lower portions, the numerous jets having force enough to penetrate the water surface about 3 inches. In addition to injecting air into the water, such an arrangement lowers the temperature of the water perceptibly. On excessively hot days, an electric fan plays on the jets; and with this accessory it is possible to reduce the temperature of the water by 4° F.

The transportation of fishes calls for aeration whenever conditions are such that the water cannot be frequently renewed. Shipments by train are ordinarily made in comparatively small metal tanks, and are usually accompanied by an attendant. Smaller fishes are sometimes carried in milk cans or similar containers. Air can be introduced by dipping water from the tanks and pouring it back from a height of a few inches. A hand-operated compressor or pump is often used when several tanks are being shipped long distances. Hose connections are run into each tank, and their ends are plugged with porous linden wood which serves finely to divide the air stream. When small tanks are transported by truck, the splashing of the water caused by jostling usually serves sufficiently to aerate the water, although the use of compressed air would be an added safeguard.

Larger, wooden tanks are sometimes used to transport tropical salt-water fishes on coastwise steamships, although much of the aquarium's collecting is now done in a specially built vessel having a well in the hull. The tanks are arranged in two parallel rows, and between and above them is set up a manifold which consists of one water pipe and two compressed-air pipes having take-offs at suitable intervals. Ordinarily, sea water is supplied to the tanks by one of the ship's pumps, the discharge being carried overboard. Tropical fishes cannot stand cold water, however, and when they are being taken northward from Florida, the Bahamas, or Bermuda during cold weather, the water circulation is discontinued as soon as the vessel passes out of the Gulf Stream. Aeration is then resorted to, the air being secured from a steam-driven reciprocating compressor which is a part of the aquarium's collecting equipment.

In general, the aquarium experts say, it is easier and less expensive to transport 500 small specimens than one large one. For example, it costs less and is safer to ship a lot of king crabs from New York to England than to transport one large sturgeon from the Delaware River to New York. When small fishes are to be shipped great distances without attendance, oxygen is employed. One way of doing this is to fill a wide-mouthed jar with water and to place the fishes in it. The jar is then inverted in water while oxygen is introduced until it replaces about one-third of the water. Tightly corked and further sealed against escape of the gas by a parchment covering around the top, the jar is ready for a long journey. Fishes and small invertebrates have been sent to Germany—a 9-day trip—in this manner. Trout fry and large fishes have both been successfully shipped in tanks connected with flasks of oxygen under pressure, reducing valves admitting the gas to the water at low pressure.

Because of the diversification of the menu required and the fact that there are 5,000 steady boarders, the feeding of the specimens at the New York Aquarium is a chore of considerable magnitude. The cost of food is around $3,500 a year, of which three-fourths is for market food and the rest for live food. More live food is used in the summer, when it can be obtained more readily. It formerly was the custom to feed every day, and one attendant devoted half his time to the preparation of the food. Specimens are now fed on alternate days, with no apparent ill effects. Fish—mainly cod and herring—clams, and meats are sliced, chopped, or minced, according to the size of the creatures to be fed. Care is taken against over-feeding, as unconsumed food quickly fouls the water. Records for one month show the following amounts of food bought from markets: herring, 2,160 pounds; clams, 5,200; shrimps, 39 pounds; butterfish, 25 pounds; beef heart, 28 pounds. When salt-water minnows are easily obtained, from 10 to 12 quarts daily are thrown alive into the tanks. Live shrimps, crabs, and mussels are also used. Considerable quantities of beach fleas and sand hoppers are likewise consumed. Certain specimens must have the food to which they are accustomed; and at some times in the year great difficulty is met in obtaining it. A sea cow formerly on display had a liking for lettuce, cabbage trimmings, and limited amounts of bread, but preferred salt-water eel grass, of which it ate some 18 bushels a month. Sea turtles and some fishes—notably carp—also will eat certain vegetables in varying amounts.

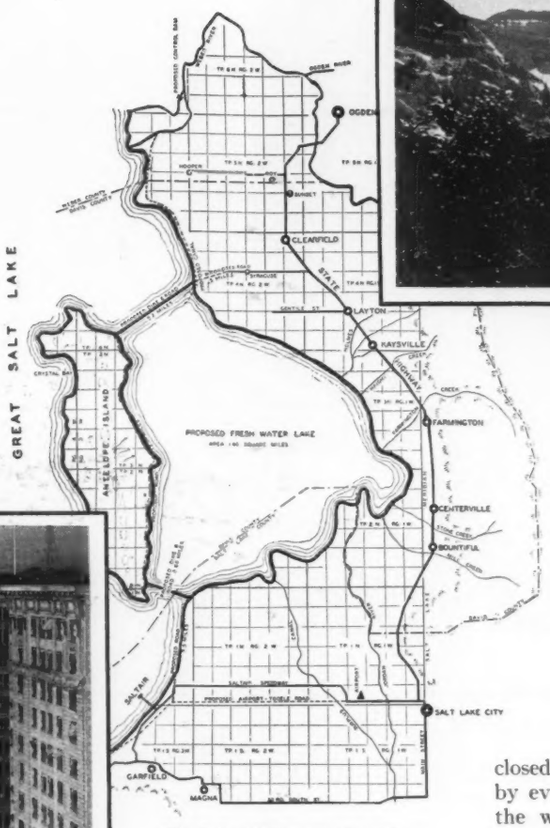
Bed of sand filter for sea water, showing saw cuts in drainage pipes. Four small air pipes also are visible.

A Fresh-Water Reservoir in a Salt-Water Lake—

RUSSELL C. FLEMING

Photo, L. S. Gillham, Inc.
Timpanogos Peak, in the Wasatch Mountains.

Photo by Carrigan
A business street in Salt Lake City.



Sketch of the proposed fresh-water lake in a portion of Great Salt Lake.

IN July, 1847, a group of 162 men, women, and children—Mormons driven from their homesites in Illinois to seek a new home in the arid and Indian-infested West—topped the crest of the Wasatch Mountains in what is now north-central Utah. Gazing over the broad valley and the shimmering lake spread out below to the westward, Brigham Young, their leader, declared this was the place they would settle.

From the reports of early explorers, notably that of Fremont in 1843, the leaders of this weary, dusty, and footsore migration knew that the promise of fresh cool water from the lake before them was a delusion—that Great Salt Lake was one of the saltiest bodies of water in the world. Streams flowing down to it from the mountains, however, gave promise of sufficient fresh water for their needs. On the day of their arrival in the valley, one of these streams was diverted on to a patch of hard, arid, and sage-brush-covered soil, and fields were plowed.

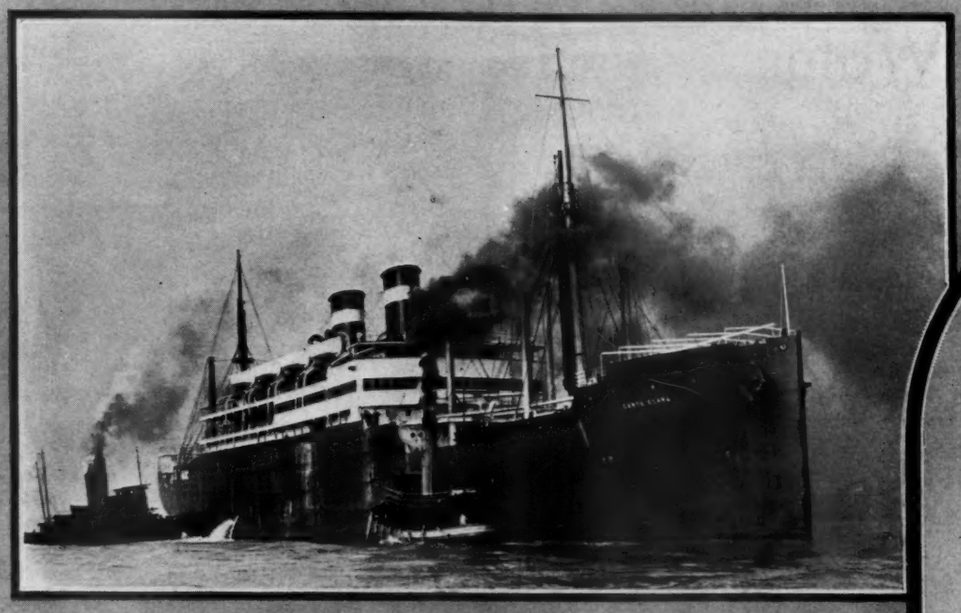
From that beginning the territory, and later the state, of Utah was developed. Since the arrival of those first settlers, one of the foremost problems has been a sufficient quantity of water for agriculture and industry. As Great Salt Lake has a saline content, depending on the amount of rainfall and the rate of evaporation, ranging from 15 to 23 per cent, its waters are useless for most purposes. Modern and beautiful Salt Lake City has grown up near the eastern shore. According to the last census, the state has a population of 507,821; but a recent survey indicates that between 1920 and 1930 one out of every five people of the normal increase expected within the state had to migrate to other fields for a livelihood, a condition that has been traced to an inadequate industrial development. Utah is rich in resources of coal, metals, and nonmetallics—resources not exceeded by any other state in the Union. Yet the refining and fabrication of the metals produced, and the founding of chemical industries based on the many salts to be obtained from the lake waters, have lagged for lack of cheap power. The coal cannot be exhausted in generations; but to utilize it for power generation on a big scale requires large amounts of water for condensing purposes, and all the apparent water supplies were appropriated long ago.

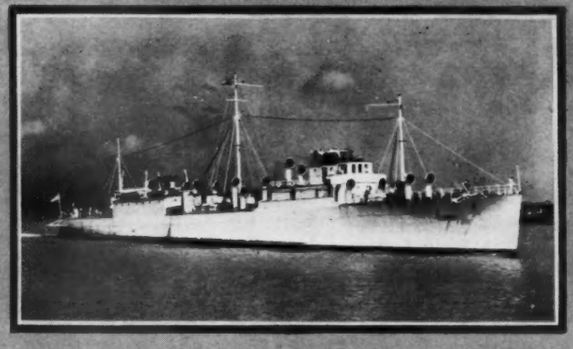
It is said that many years back Ferdinand de Lesseps, the renowned French engineer who built the Suez Canal and first attempted to dig a canal across the Isthmus of Panama, suggested the possibility of forming a fresh-water reservoir from a part of Great Salt Lake. Recent investigations show such a project to be feasible; and a coöperative committee of citizens of Salt Lake Valley is completing plans to carry it to fruition. Engineering studies have established that ample water can be impounded in this way to furnish power at low cost to a variety of industries.

Great Salt Lake is the largest inland body of water in the United States west of the Mississippi River. It lies in the bottom of a tremendous closed basin; and as it has no outlet except by evaporation, and collects the drainage of the whole basin, it has become extremely salty—averaging 20 per cent salt, or 1 pound of salt in each 5 pounds of water. In density it is exceeded in the world only by the Dead Sea of Palestine. The average maximum dimensions of the lake are 75 miles long by 50 miles wide, although, because of the low-lying shore line and varying rates of inflow and evaporation, its area varies considerably, measured over a period of years. The water level was at the lowest stage ever known in 1905. Then, in 1924, it rose to a new high, but has since been declining. At present it has an area of about 2,000 square miles. Salt flats surround the lake; and the chief commercial product now obtained is table salt, produced by solar evaporation of the brine.

Large as Great Salt Lake is, it is only the remnant, collected in the lowest part of the basin, of a much greater fresh-water lake which in Pleistocene times filled the whole basin, covering nearly a fourth of the State of Utah and extending into Idaho and Nevada. That body of water was as big as Lake Michigan, with an area of 19,750 square miles, and had an outlet north to the Snake and Columbia rivers. The water level was gradually lowered as the outlet channel was deepened through erosion; and then, with an evident change in the amount of precipitation or the climate, the water level continued to lower without an outlet and the saltiness and density of the water to increase until only the present Salt Lake remains. Shore lines of that ancient lake—called Lake Bonneville after Captain Bonneville, an early investi-

(*Continued page 3886*)





Nesmith Ewing Galloway

Top left photo, Grace Line

Greyhounds and Dra Ho

AT the top of the page, in the corners, are two modern passenger ships, the Grace liner "Santa Clara" on the left, and the "Aquitania" on the right.

The central view shows the "Star of Alaska", a clipper ship that harks back to a former era. In the small panel at the left of this square rigger is a "felucca", a queer-looking craft of the Nile. In corresponding position on the right is the stern-wheeler "Dalles City" of Portland, Ore.

The other four pictures depict various

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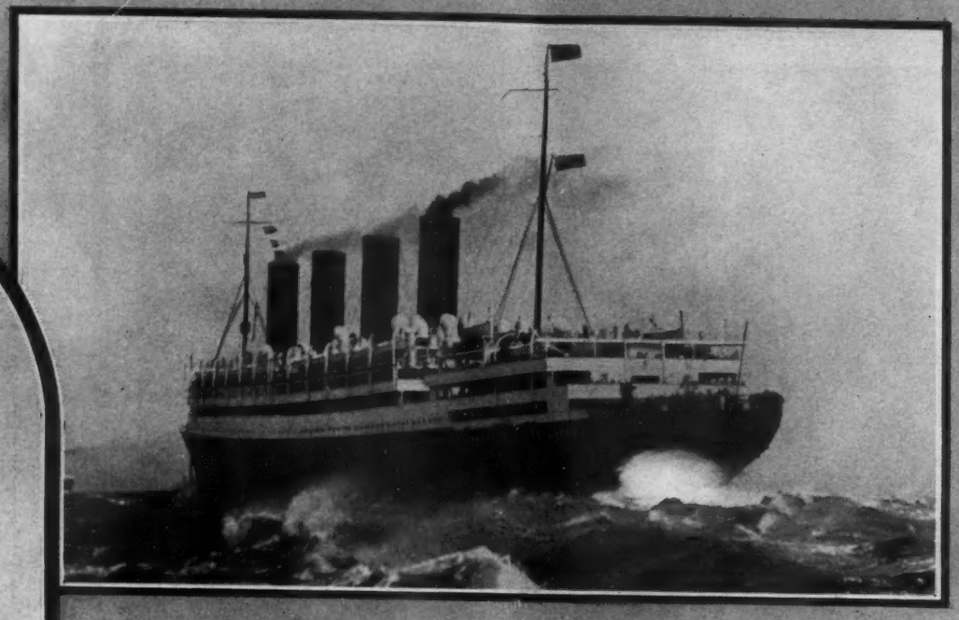
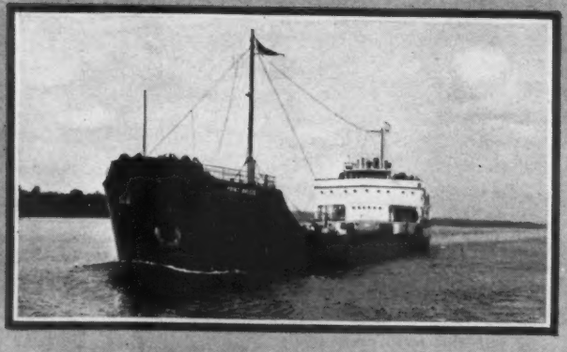


May Mott-Smith



Top right photo © Morris Rosenfeld

Horses of the Sea

types of boats which are driven by Ingersoll-Rand oil engines. The bottom view at the left shows the "Golden Poppy", a ferry boat that plies San Francisco Bay. Above it is the "Tabasco", once a destroyer and now a carrier of bananas from Honduras.

In the right-hand lower corner is the "Point Breeze", an Atlantic Refining Company tanker. Above it is the "Cleveland", one of four 1,000-horsepower tugboats recently put into service in New York Harbor by the Erie Railroad.

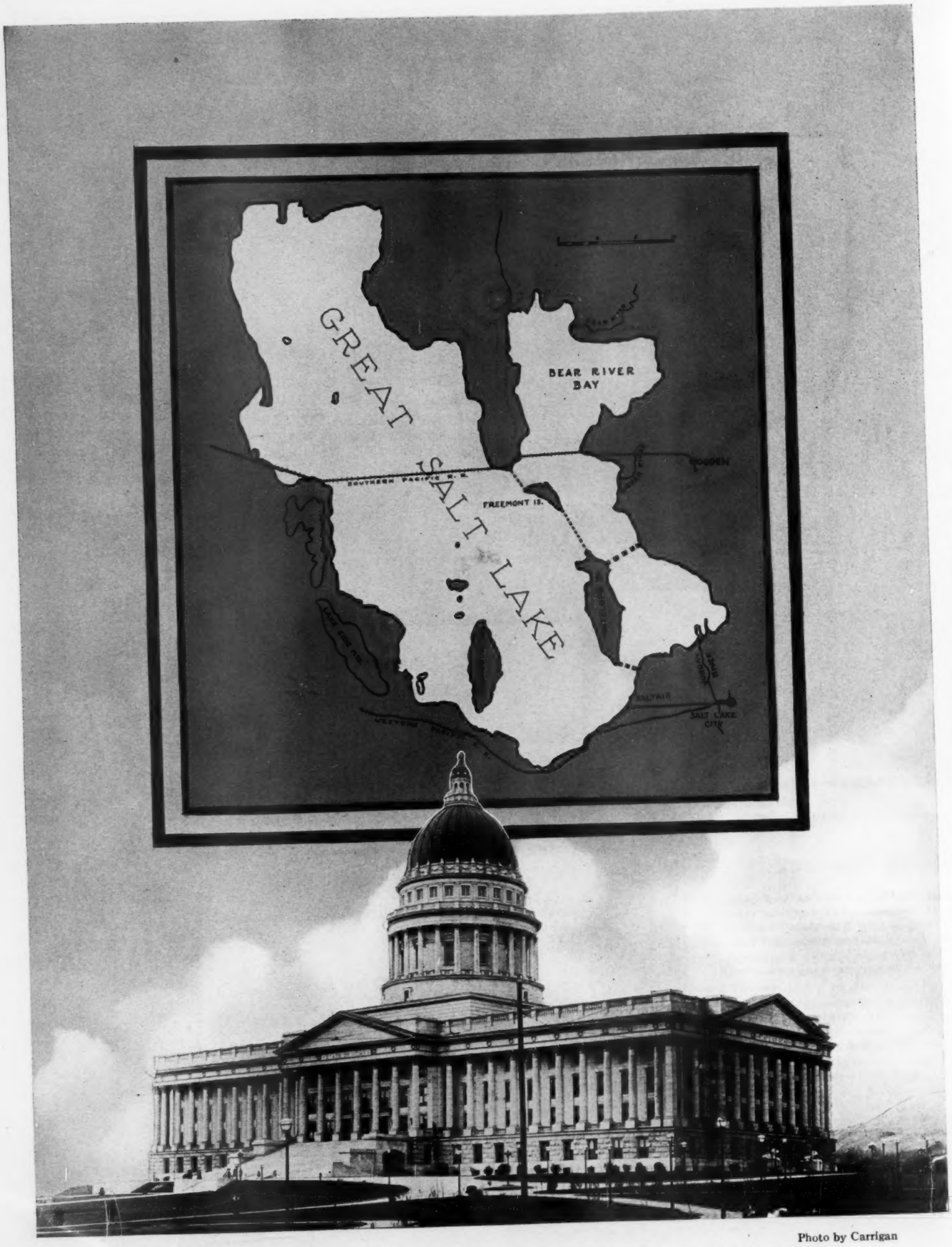


Photo by Carrigan

The dotted lines on the map indicate the positions where dikes would create a fresh-water area in the great body of saline water. At present it is proposed to build dikes at the two points marked by heavy dots. The lower picture is of the Utah State Capitol in Salt Lake City.

gator of the basin, are easily discernible high on the mountainsides bounding the basin. The flats west of the lake, shown on maps as Salt Lake Desert, were once a part of the ancient lake bed and are too saline for agricultural use.

It is a known fact that most of the water used in the valley again finds its way into the stream beds and eventually into Great Salt Lake—the Bear, Weber, and Jordan rivers, as well as many smaller streams and some subterranean water, flowing into the eastern part of the lake. As Antelope Island, Fremont Island, and the long Promontory Point jutting out from the north shore largely divide this eastern section from the rest of the lake, it is possible to close up the gaps by comparatively short lengths of dikes and thus to impound most of the fresh-water inflow.

An engineering committee is investigating the project and formulating plans to carry it to completion. As outlined in the progress report of that committee, only a portion of the whole eastern area would now be enclosed. A dike, 2.63 miles long, would be built from the southern end of Antelope Island, and a second dike, 5.2 miles long, from near the northern end, both connecting with the eastern lake shore and enclosing an area of 146 square miles. According to plan, material would be dredged from the reservoir bottom to form the dikes—the dikes to have a minimum top width of 34 feet and a 40-foot top width across the deeper fills. A maximum ratio of 15 to 1 has been set for the side slope of the deeper fills and of 10 to 1 for the shallow fills. On this basis it is estimated that the dikes would contain 3,500,000 cubic yards of material. The average bottom width of the north dike would be 274 feet and of the south dike 204 feet. Wave action of the heavy brine is severe; and as the water is too saline to freeze, the dikes must be built with a beach slope to withstand this action the year round. Borings show a firm clay foundation along the line of the north dike, but 7.5 feet of clay and sand overlying 20 feet of loose black marl along the line of the southern dike. A graveled roadway would top each dike, connecting Antelope Island with the mainland and making it accessible as an amusement and recreational center.

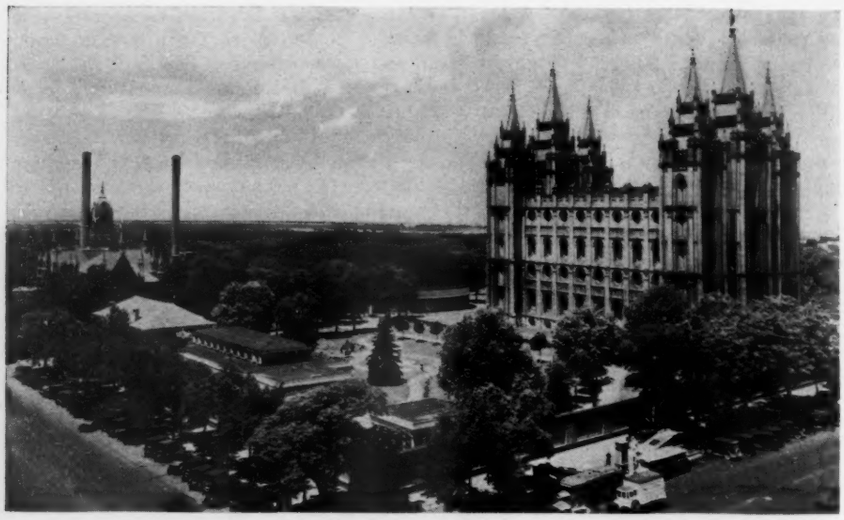
Into the reservoir so created would flow the Jordan River, the Surplus Canal from the Jordan River, many smaller creeks and flood waters, as well as the natural precipitation over the area. The flow of the Bear River cannot be impounded within this area; but the plans call for a canal, 8.5 miles long and just above the lake high-water level, to divert the Weber River into the reservoir. The average annual water supply from these sources is estimated at 813,000 acre-feet, and the average evaporation loss will be about 344,000 acre-feet, leaving a net available supply of 469,000 acre-feet per year. The maximum depth of water in the reservoir, with the water surface at an elevation of 4,203 feet above sea level, will be 12 feet. At that elevation the reservoir will contain 437,000 acre-feet, or a volume 31,000 acre-feet less than the net yearly inflow. For two months during the average summer, evaporation in the reservoir will exceed inflow by 68,000 acre-feet, and will cause a lowering of 10 inches in water level. However, the balance between inflow and evaporation will be restored by autumn, when the water level will return to normal. Pumping out an additional 75,000 acre-feet for use during the summer months would lower the water level an additional foot.

A scenic highway in Big Cottonwood Canyon.

The present lake level is 4,198.4 feet above sea level. Plans call for dikes to be built to a top elevation of 4,210 feet, inclusive of the graveled roadway on top of the earth fill. The dikes will be wide enough to permit raising them should that become necessary. The water level in the reservoir would be held at a maximum elevation of 4,203 feet, unless the lake level should rise greatly. With the lake level as it is now that would provide a head of 4.6 feet of fresh water above the salt lake water. Because the salt water is much denser, a minimum head of 1 foot would have to be maintained on the reservoir side to keep the flow from the fresh-water side moving outward through the automatic 1-way gates to be placed under each dike. In other words, if the fresh-water level were less than 1 foot above the salt-water level, salt water would tend to flow into the reservoir through the proposed submerged gates. Not to interfere with the present established riparian rights along the shore line, the reservoir water level cannot exceed Elevation 4,205 feet. But should the lake level rise so that a higher water level has to be maintained, no difficulty would be experienced, as it would certainly be less serious to flood the adjacent lowlands with fresh water than with salt water, which would be the case if the lake level rose to that stage and the reservoir were not established.

As the lake level is now low, only a portion of the proposed reservoir site is covered, and with about 112,000 acre-feet of salt water. That water must be disposed of after building the dikes before the stored water will be fresh enough for use. It could be pumped out at an estimated cost of $125,000, but a simpler and less expensive plan is projected. If the waters were allowed to commingle and the excess to overflow the spillways, a long time would be required to freshen the contents; but studies made in Bear River Bay, where the Bear River flows into the lake, show that fresh water does not commingle readily with salt water but tends to spread out over the surface of the salt water in a broad fan. Small-scale laboratory tests bear out that observation. That being the case, it is deemed expedient to displace the salt water with fresh water by providing each dike with submerged sluiceways having automatic 1-way gates and with their intakes extending to the deepest part of the reservoir. Then, as a head of water is built up in the reservoir, the salt water will be forced out at the bottom and displaced by fresh. Since the annual net inflow is greater than the reservoir capacity, all the water in the reservoir will be replaced yearly. With a gate area of 200 square feet in the submerged sluiceways, it is calculated a head of 1 foot would be sufficient to discharge all the salt water now in the reservoir area within two months.

In addition to the submerged sluiceways, overflow spillways will be built in rock on the island at the end of each dike, with flashboards to regulate the height of water in the reservoir. Control of water during times of flood must also be considered. The flood flow of the Weber River in the spring months can be controlled, if necessary, at the dam where that river will be diverted into the canal leading to the reservoir and the flood waters passed directly from the diversion dam to the lake. The remainder of the flood flow, estimated at 900 second-feet, can be handled by the spillways. Also, if the reservoir level should rise sufficiently to back water up into the Weber River canal, excess water could be passed to the lake through control gates in



The Mormon Temple, in Salt Lake City, which is classed among the nation's most beautiful buildings.

the side of the canal.

Though boats skim over the waters of Great Salt Lake rather than cut through them, the lake is considered navigable for small craft, and this must be considered in building the reservoir. Owing to the low-water level, boats can now only come around the north end of Antelope Island and partway down the eastern side. However, with a relatively deep body of fresh water available, some provision must be made for transferring boats from one side of the dikes to the other. A traveling crane is planned on the north dike which can handle craft of the size used on the lake. The reservoir is to be stocked with fish, and should prove a mecca for wild fowl in an arid region.

Included in the plans are the roadways on top of each dike and the connecting roadway on the island following the winding eastern shore line—a 20-mile lake-shore drive. Excellent beaches exist on both sides of the island, and it is thought that a recreational center with both salt- and fresh-water bathing can be built up there. For years one of the favorite places of amusement has been a pier on the lake, at Saltair, where one can have the unusual experience of bathing in water in which one cannot sink. A person can float indefinitely without effort.

As outlined, the dikes will be built and maintained by suction dredges, and the cost estimate has been drawn up with that in mind. Including the dikes and spillways, the roads to and on the island, the Weber diversion dam and canal, and bridges over both spillways and over the canal, the cost has been figured at about $750,000.

The possibility that the strata under the reservoir site may be filled with salt, which might leach into the fresh water and contaminate it for a long time to come, has been discounted, as borings to a 25-foot depth show that such salt strata do not exist. It is believed that the subterranean water filtering into the reservoir site has kept the strata well leached of deposited salt.

Completion of this reservoir will probably not mark the end of efforts to reclaim the Great Salt Lake area. If you will look at the map you will notice that Antelope Island, Fremont Island, and Promontory Point form a chain to separate the eastern part of the lake from the remainder. As a matter of fact, these islands and the point are projecting peaks of a mountain range, now mostly submerged. The original plans called for dikes connecting all these points so as to cut off this entire eastern portion where all the inflow occurs. That plan has now been modified, as described; but if the one bay is satisfactorily enclosed, the more ambitious project will be reconsidered later.

Public-spirited and forward-looking citizens of Salt Lake City and vicinity, representatives of various public and private agencies, compose the committees engaged on this project, and while the financial arrangements are not yet completed, announcement is soon expected to the effect that the work will be undertaken. When it is done, another of the earth's waste spots will have been turned to the uses of man.

PERFORATED SHEET RUBBER A GOOD AERATING MATERIAL

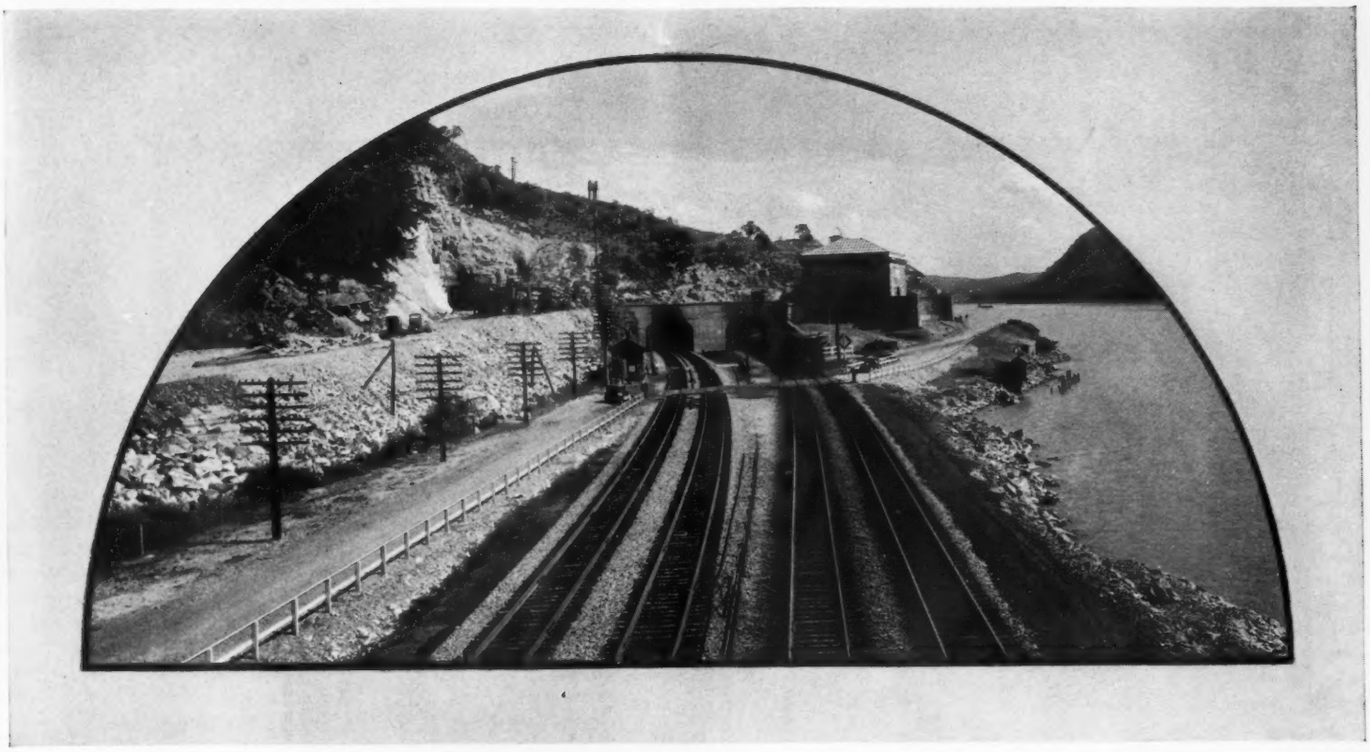
SINCE the General Engineering Company first began to use sheets of perforated rubber on its MacIntosh pneumatic flotation machines for aerating the mixture, rotor covers of this material are said to have fairly generally supplanted those of canvas formerly used for the purpose. The sheets are 5/64 or 6/64 inch thick, and have 225 perforations to the square inch. These are made with a 0.038-inch punch, and are in the shape of a dumb-bell. There is an advantage in this, as the hole, because of this form, has a tendency to close up when the air supply is shut off and the rubber contracts, thus preventing the passage of the finely divided solids and water. A special method has latterly been developed for perforating the sheets so as to insure a product of uniform porosity.

Much experimenting was done by the General Engineering Company and many materials were tried before it was discovered that pure gum rubber, properly perforated, was particularly well suited for the purpose. Compared with canvas, approximately 40 per cent less power is required to do the work; it has a longer service life—some of the rubber covers having been utilized continuously for a period of a year and longer; and it aerates the flotation pulp far more effectually. This is due mainly to the multiplicity of small, uniformly distributed air bubbles, and to the fact that the air encounters little resistance in passing through the openings.

It is the belief that sheets of perforated rubber might be used to advantage in numerous directions in chemical plants; and investigations are even now underway with the object of determining whether or not they would be suitable for filtering certain crystalline solutions, for activating sludge, for purifying various liquids, etc. It is suggested, however, that in each separate case efforts first be made to find out what is required in the way of stock, thickness of sheet, size of hole, and number of openings per square inch to obtain the highest efficiency.

Photos this and preceding page, L. S. Gillham, Inc.

Saltair amusement pier and bathing beach. It is impossible to sink in the highly saline water.



The new Breakneck Highway Tunnel is shown at the left of two New York Central railroad bores. The structure at the right stands over a shaft leading to the New York City aqueduct.

Breakneck Mountain Again Burrowed by Rock Drills

Stubborn Point on the Hudson that Impeded the Progress of Glaciers Once More Yields to Blasters

ALLEN S. PARK

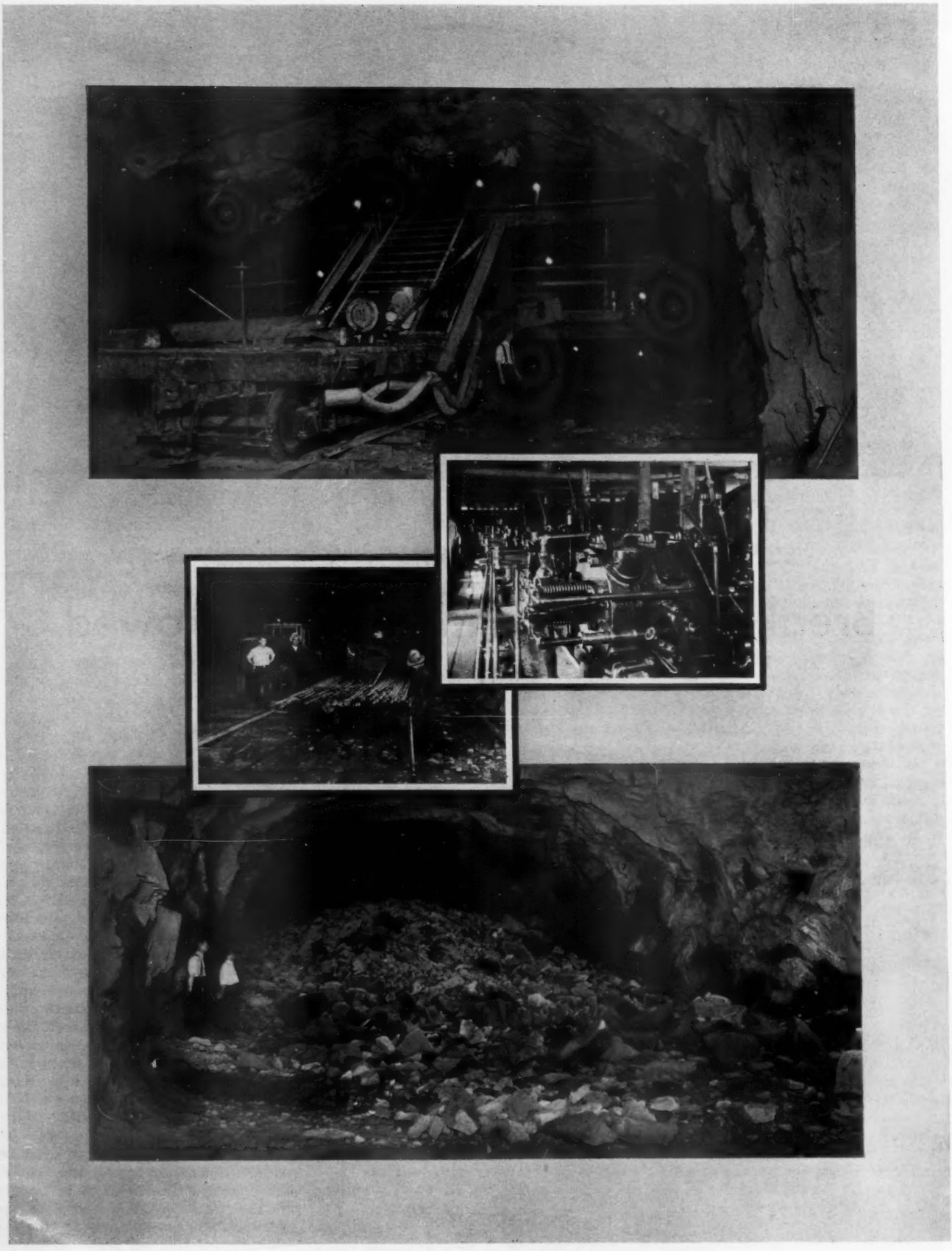
SOME fifty miles north of New York City the Hudson River flows between two opposed jutting noses of rock, Storm King Mountain on the west, and Breakneck Mountain on the east. Geologists tell us that they were once integral parts of a ridge, perhaps a rather lofty one, which ran athwart the present riverway. Then came the ice age, when glacial tongues were thrust down from the northward, one following another until their combined efforts had gouged and scoured a great gorge which, later, was almost filled with silt, sand, and bowlders to form the floor of the present river bed.

Evidently the ice streams found this rocky barrier across their path a doughty foe, for the valley of the Hudson narrows there, showing that only the central and more powerful portions of the recurring glaciers were able to carve deeply into and through the ridge. Today, with the serene Hudson separating them, the gneissoid shoulders of Storm King and Breakneck rub the water's edge and challenge the passage of man-made transportation agencies. Storm King rises somewhat sheer: Breakneck slopes more gradually away from the river, but even so it rises high enough to block the pathway of travel arteries that seek to follow water grade. The glaciers would have accommodated modern engineers had they been a little more thorough in their work.

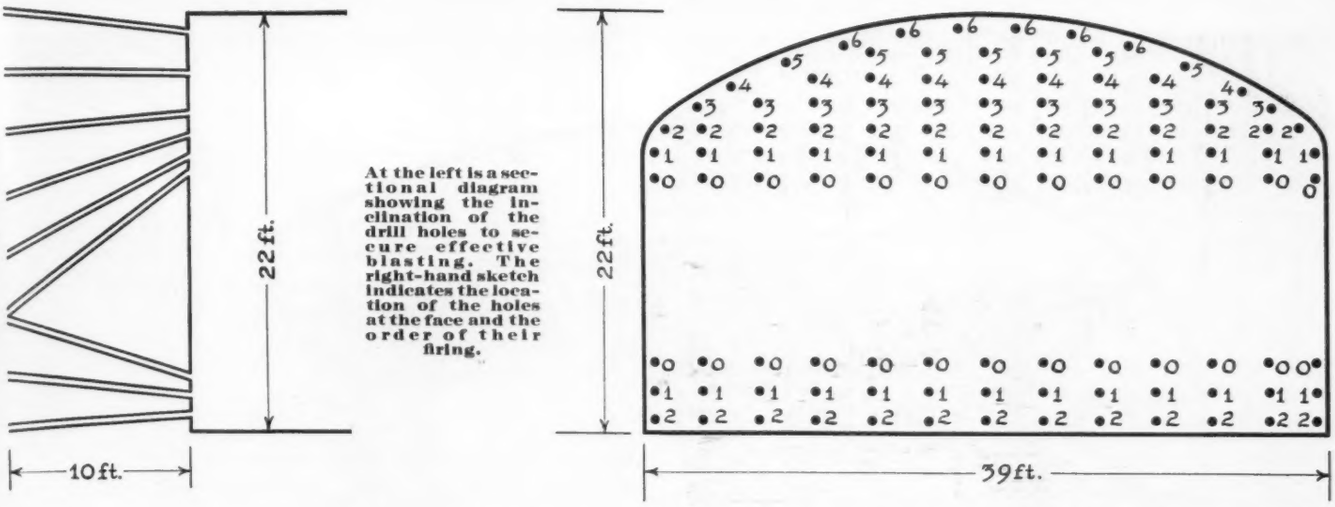
This rocky nose of Breakneck Mountain has had little peace and repose since New York City to its south sprang into eminence as the nation's Metropolis and demanded to be served with the necessaries and luxuries of life with the dispatch that befits its position. If it could speak, this comparatively inconsequential hill might give an interesting account of progress in methods of drilling rock, for its core has felt the touch of many drills. It was first pierced nearly a century ago, when the New York Central drove a railroad tunnel through it by hand-drilling methods. In 1910 a shaft was sunk and a connecting tunnel driven as links in the notable engineering work of providing means for furnishing New York City with water from the Catskill Mountains. The aqueduct crosses 1,100 feet beneath the Hudson River at Breakneck in a solid rock tunnel. In the sinking of the shaft a new record for progress in such work was established.

The driving of the water tunnel, which forms the continuance of the aqueduct from the shaft towards New York, marked the first use in the eastern part of the country of the Leyner hammer-type rock drill, the parent of modern Ingersoll-Rand drills and even then an accepted machine in the mines of the West. Contractors who bid on sections of the aqueduct construction sent representatives to view this new creation in action and to prevail upon the manufacturer to let them have some of the drills for trial in the event that they secured portions of the work.

For the better part of the next score of years, the mountain was left alone by human burrowers, but in 1928 they resumed their attacks. In that year the New York Central Lines added two tracks to the existing 2-track system—the main line of entry into New York City. The original tunnel was enlarged, and an adjacent paralleling one was driven. These operations were conducted by



From top to bottom the pictures show, a drill carriage in position at a heading; interior of the compressor house; unloading a truck of drill steel in the tunnel; a heading after a blast.



At the left is a sectional diagram showing the inclination of the drill holes to secure effective blasting. The right-hand sketch indicates the location of the holes at the face and the order of their firing.

the Walsh Construction Company of Davenport, Iowa, and were described in *Compressed Air Magazine* for August, 1928.

This year the Walsh organization returned to the familiar scenes, and has been engaged in driving still another tunnel through the lower slope of Breakneck Mountain. This latest bore is for vehicular use, and is a part of road improvements being made between Bear Mountain Bridge and Beacon on New York State Highway No. 5728, which is familiarly known as Route 9D. In order to pass around the toe of the mountain, the old road had to cross the railroad both north and south of the elevation, giving rise to two dangerous zones, which were increased to four when more tracks and the second tunnel were added. At these crossings, and more especially at the southernmost one, approaching trains were obscured to the view of motorists until they were very near. To eliminate these hazardous crossings, it was decided to run the highway through the lower slope of the mountain and thereby keep it above and to the landward side of the railroad tracks. This work is being carried on as a joint undertaking by the parties concerned. The railroad company is paying 50 per cent of the cost, the State of New York 49 per cent, and Putnam County 1 per cent. The tunnel is almost on the dividing line between Putnam and Dutchess counties.

The Walsh organization received the contract as low bidders, and moved their first equipment on the job in March. A considerable amount of scaling and open-cut work was required to gain sufficient cover to form faces for the tunnel portals. In some cases, this scaling extended to a height of more than 250 feet above the roadway level.

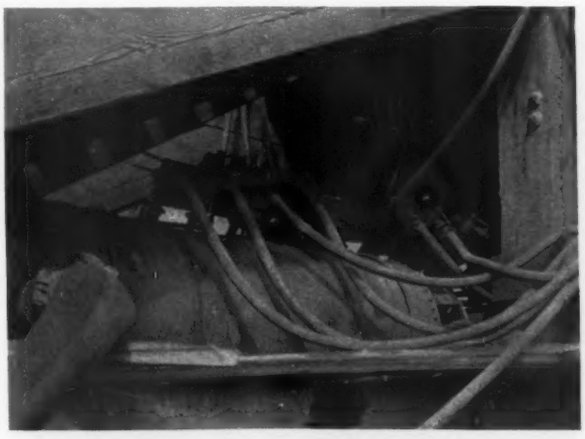
Although only 545 feet long, the tunnel measures 39 feet across at the base and 22 feet high in the center and, accordingly, can be classed as a major highway tunnel. It has vertical sides and a roof which is an arc of a circle described on a 58-foot radius. Each linear foot of advance called for the excavating of 30 cubic yards of material. When completed, it will be lined on the sides and top with concrete and will have a 30-foot concrete roadway which will connect with a 20-foot concrete highway at either end.

Profiting by the experience gained while previously engaged on similar work in that section, the contractor made a notable record for speed in driving this bore. Tunneling operations were started on May 25, and were completed on June 29. Except for the fact that the first 12 feet at either end had to be line-holed and broached, it is certain that the job would have been holed through in less than a month. This could have been accomplished in any event had work been carried on 24 hours a day instead of in two shifts of eight hours each. Headings were driven from both ends; and after the portals had been established an average advance of 20 feet of hole was made daily. This headway was divided more or less evenly between the two faces, although the methods followed permitted one shift to progress a little faster than the other.

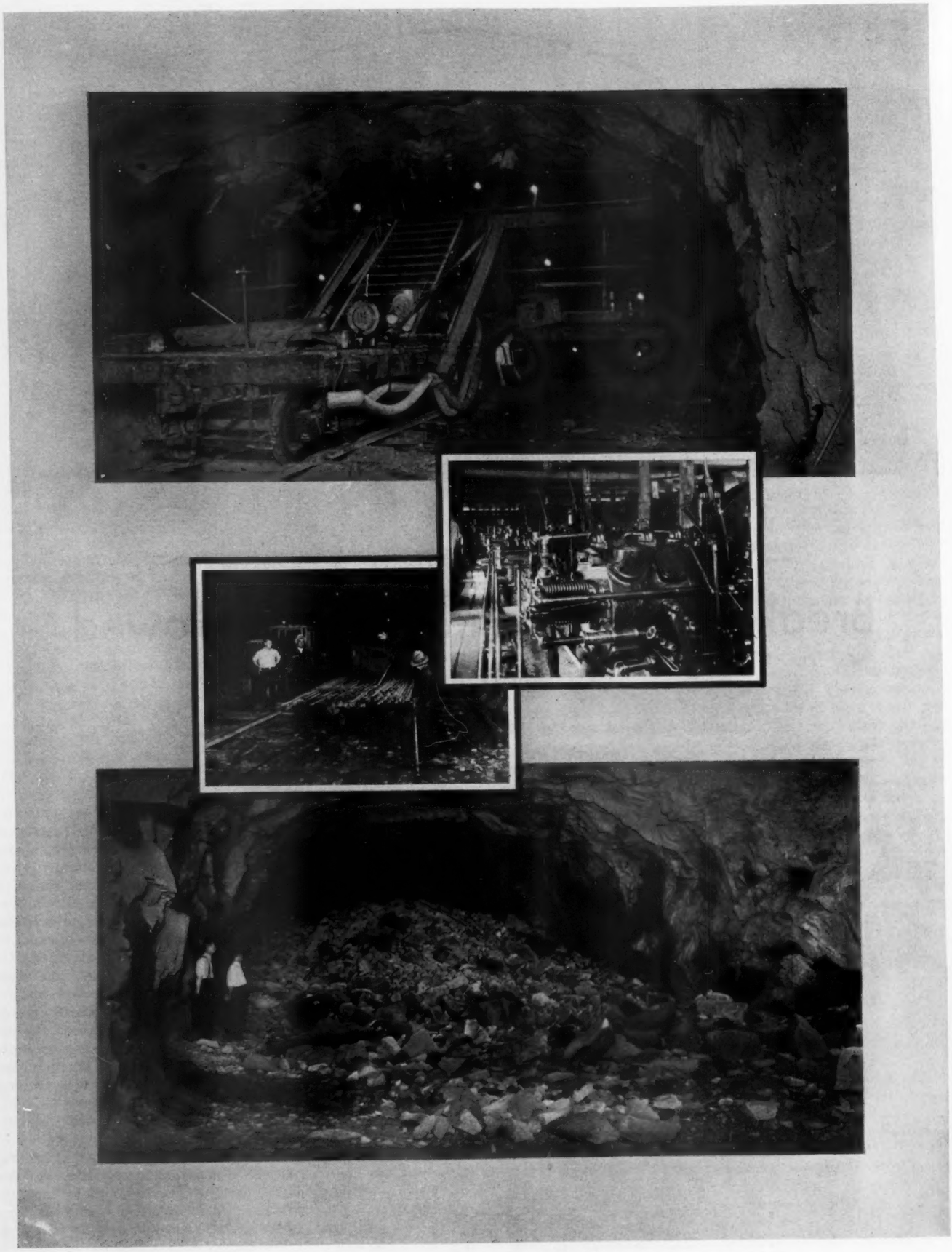
The tunnel was driven by the aid of two drill carriages, each mounted on a railroad flat car. Fourteen Ingersoll-Rand Type X-71 drifter drills were used on each carriage. The general features of construction of these drill rigs are shown in accompanying illustrations. The carriages were essentially the same as those developed by the same contractor for driving the adjacent railroad tunnel four years ago, only such changes being made as were required by the difference in the cross section of the bore. The carriages on the current work provided three working levels, of which one was on the ground and two were on platforms. Compressed air was piped into the tunnel close to the headings, and in each case a 50-foot length of flexible 4-inch hose was used to make the connection with the carriage. The air entered a small horizontal receiver mounted at the rear of the lower platform of the carriage. This receiver fed air to a manifold on top of it and bearing individual take-offs for hose connections to the drills. A separate water manifold was installed, water pressure being had from a tank outside the tunnel that was operated on by compressed air.

Because of the nearness to the railroad tunnels, care had to be taken in driving the first few feet. To this end, line holes were drilled at intervals of about 3½ inches all around the tunnel line at the sides and top, and the rock between them was removed by broaching prior to taking out the central core. This procedure necessitated the drilling of nearly 300 peripheral holes and was, in consequence, a slow and tedious job. Once the carriages were under cover, a standard drilling round was adopted, as shown in an accompanying sketch. This round consisted of 85 holes within the body of the material to be removed and 28 line holes around the edges. The average round advanced the heading approximately 10 feet.

As the work was organized, the day shift had the north heading and the night shift the opposite face. The day drillers put in their round in from five to six hours, after which the carriage was hauled out with Plymouth gasoline locomotives, the advance trackage pulled up, and the heading turned over to the blasters. The day workers then moved into the south heading, which had been mucked out before their coming. After laying the track up to the heading, they took the carriage in, barred



Compressed-air manifold and hoses on one of the drill carriages. Water lines are shown in the background.



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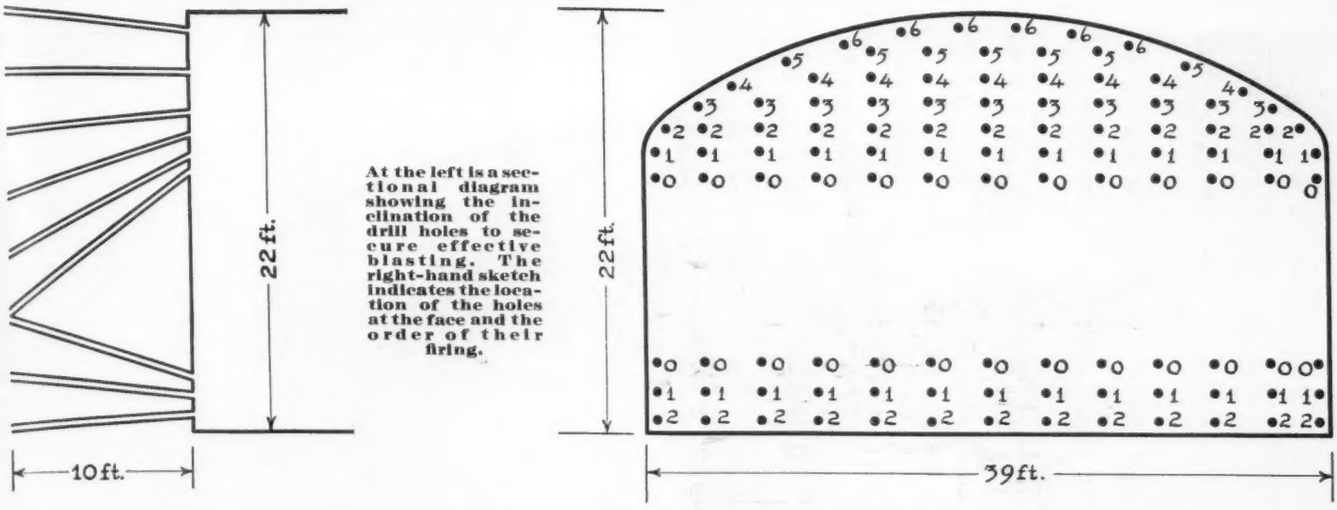

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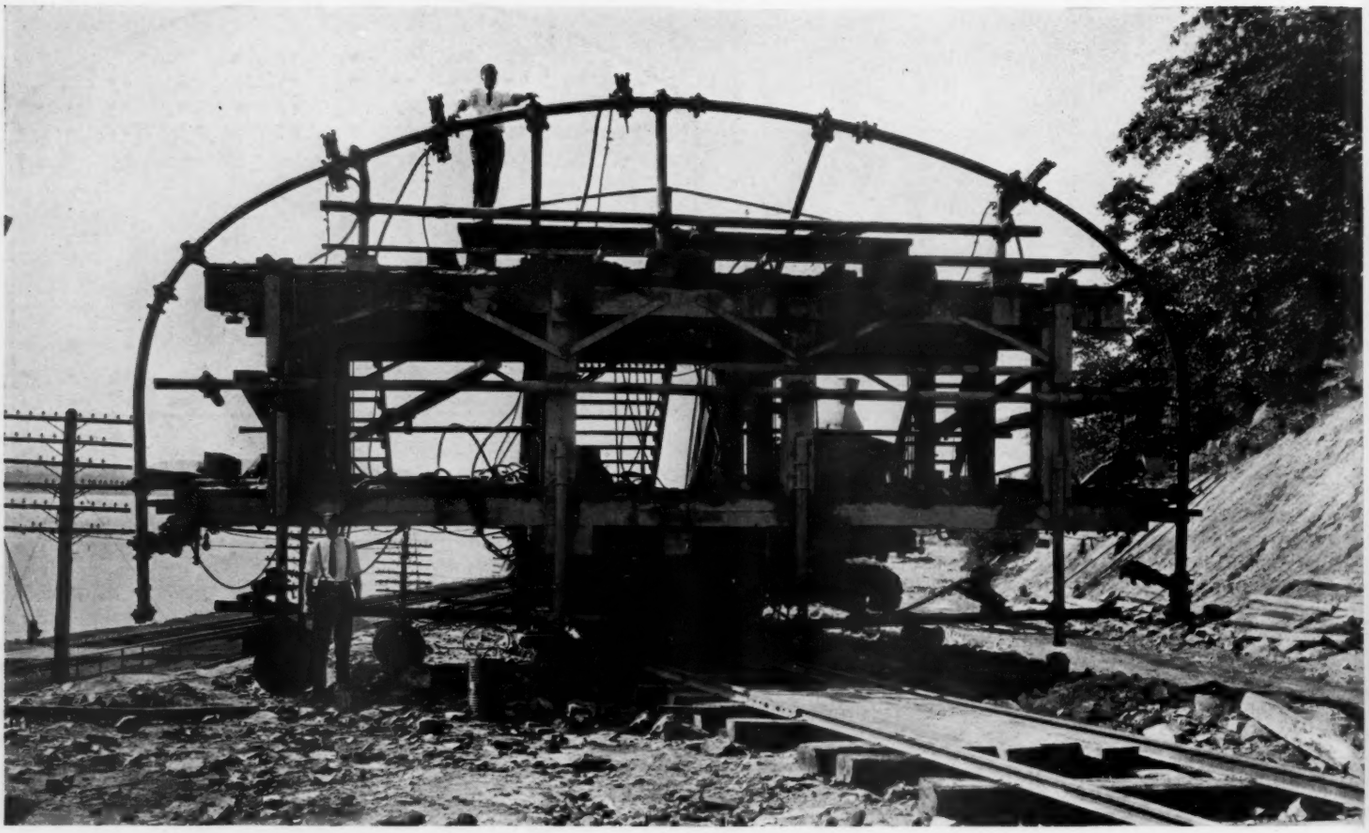


Looking at the front of one of the drill carriages.

down any dangerous rock overhead, pointed the drills, arranged a supply of steel for each driller, and otherwise made complete preparations for the night shift so that the men could start drilling as soon as they came to work. The night crew was allowed to leave as soon as its round had been completed. This obliged the day force to prepare its own carriage for operations when it came on duty in the morning.

The drill carriages used on this work are among the largest ever built and probably exceed in size any similar contrivance previously used for advancing a highway tunnel. One essential difference between these carriages and the ones used in the diversion tunnels at the Hoover Dam site is in the manner of their mounting, those at the dam being built upon 5-ton trucks. It is worthy of note that, in the operations under discussion, the entire breast was drilled from the carriage, there being no small heading of any sort carried in advance of the main face.

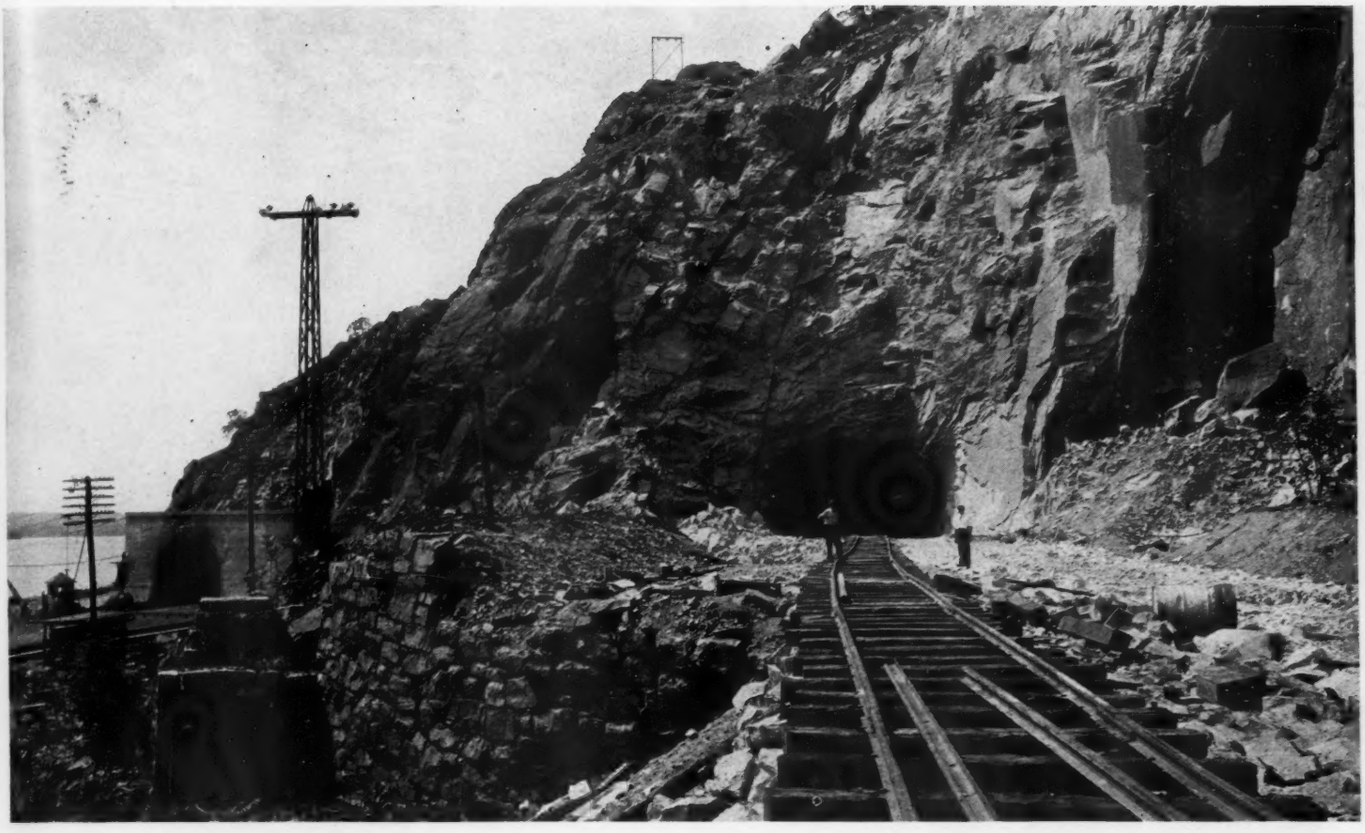
The rock penetrated is a gneissoid granite which broke well and which stood without timbering. Blasting was done with duPont special gelatine dynamite in 1¼x8-inch cartridges, 60 per cent strength being used in the bottom holes and 40 per cent strength in the top holes. Firing was done electrically.

Mucking was handled by crawler-mounted Bucyrus-Erie shovels, a 30-B at the north heading and a 41-B at the south heading. Spoils were removed in Mack 5-ton trucks. The material was dumped along the line of the roadway leading to either portal, and was sufficient in quantity to build up about 1,000 feet of grade at each approach. These sections were included in the contract, which called for the construction of approximately half a mile of highway. Another contract is underway on a section of road immediately south of the work under discussion.

Compressed air was supplied by Ingersoll-Rand Type POC-2 compressors, which consist of a 110-hp., 4-cycle, solid-injection, single-cylinder diesel engine direct connected to a 2-stage air end. Five of these machines were installed in one compressor house near the south portal. Each unit had a piston displacement of 603 cubic feet a minute. Four machines ordinarily furnished all the air required, but all five were operated some of the time. This type of compressor is well suited for service where steam or electric power is not readily available, and is characterized by unusually low operating costs. The machines used by the Walsh organization were bought about five years ago, and they have functioned practically trouble free since that time. Air for starting the oil engines was furnished by a Type DG-2 compressor which discharged at 200 pounds pressure. A duplicate reserve unit was installed. Each of the oil-engine compressors discharged into a receiver of 96 cubic feet capacity, and all five receivers were connected with an air main which fed separate branch lines to serve the two portals.

Sharpened drill steel in a quenching tank.

The drilling schedule followed called for a total of about 2,600 linear feet of holes per day; and with the changes in bits required, this involved the reconditioning of approximately 1,400 pieces of steel each 24 hours. The contractors standardized on Ingersoll-Rand 1¼-inch-section, hollow, round steel. The blacksmith shop was equipped with two I-R No. 50 sharpeners, two No. 5 oil fur-



The highway tunnel, with a railroad bore at the left.

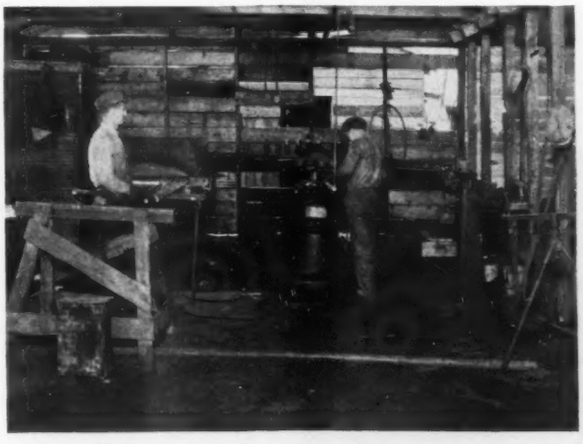
naces, and two No. 8 pedestal grinders. A similar pedestal grinder was also installed in the drill doctor's shop. A light truck was used to collect dull steels and to deliver sharp ones to the drills. Because of the large size of the tunnel it was possible to drive the steel truck right up to the rear of the drill carriage. On either side of the back of the drill carriage chutes led down from the upper platform to facilitate the lowering of steels to the ground. These chutes are visible in the top picture on page 3890.

Preparations for concreting the tunnel are now proceeding. The sides will be given a 3-foot and the arch a 2½-foot lining.

The completed road will add another scenic route to those now used by motorists entering or leaving New York City at the north, and it will serve to relieve traffic congestion on paralleling highways. At various points a vista of the broad Hudson River is unfolded. The section now under construction traverses historic ground. Within sight of the tunnel, to the south, is West Point; and the traveler who speeds along the new roadway will pass many scenes which formed settings for some of the most dramatic incidents of the Revolutionary War.

The Breakneck highway tunnel was designed in the office of the New York State Department of Public Works; and Col. Frederick Stuart Greene, superintendent, and H. O. Schermerhorn, assistant chief engineer, represented the state in supervising the operations. The work was executed by the New York Central Railroad, with F. B. Freeman as chief engineer and Thomas P. Lynch as resident engineer.

Czechoslovakia, which has no domestic supply of asphalt, reports the development of a substitute which was discovered at the Prague Gas Works. It is composed principally of coal tar and of a special kind of crushed stone, and is to be manufactured and put to use experimentally on city streets and country roads.



Interior of one of the two sharpener shops.

FRUIT GROWERS EXPERIMENT WITH NEW FUEL TO HEAT ORCHARDS

CALIFORNIA citrus-fruit growers are planning to experiment this winter with a new fuel to heat their orchards. They are going to try butane gas in an attempt to overcome the troublesome smudge and smoke they have to contend with in burning distillate. Butane gas, which is a constituent of gasoline, has until fairly recently been allowed to go to waste in the refining process. It is now recovered in liquid form, and delivered in tank cars or trucks, or containers suitable for household use, to outlying communities that are beyond the reach of public utilities. A gallon of the fuel is said to provide 48 cubic feet of gas having a heating value of 2,800 B.T.U's per cubic foot, which is considerably higher than that of natural or manufactured gas.

Two orchards are to be equipped to burn butane; and, if the results are such as to justify it, a central plant is to be established which will deliver the gas to the growers through underground pipe lines. The liquid butane will be gasified before reaching the burners. The heaters, the central plant, and the system of distribution were developed by the Liquid Gas Orchard Heating Corporation, and created much interest when exhibited for the first time at San Bernardino, Calif.

Waiting in line to receive tomato plants.
Left—The cabbage was planted May 6 and picked July 5.
Right—A gardener harvests his string beans.

From Lathe to Hoe the Workers Go

How a Manufacturing Company is Aiding 1,000 Employees to Turn Truck Gardeners on a Small Scale

LAST year the President's Organization on Unemployment Relief urged the planting of so-called subsistence gardens as one means of alleviating the effects of the economic depression. States, municipalities, industrial organizations, and other agencies were urged to promote such gardens with the following specific objectives in view: to conserve resources of families by augmenting their food supply during the growing season; to supply foods for the winter months; to encourage thrift and to help maintain the morale of families suffering from unemployment.

There was a generous response to the appeal. Five industrial states—Illinois, Indiana, Kentucky, Ohio, and West Virginia—set up plans under which a trained garden man supervised demonstrations and cooperated with local authorities and officials of industrial organizations who desired to further the growing of food crops. In many other states, numerous enterprises of similar nature were conducted, with agricultural colleges and state agricultural bureaus giving aid and advice in most cases. Following the success of these ventures in 1931, there has been a great increase in subsistence gardens this year, especially of those fostered by manufacturing companies that have been compelled, through force of circumstances, temporarily to release many of their factory workers.

As a matter of fact, such gardens have been sponsored by some concerns for a number of years. The National Cash Register Company, of Dayton, Ohio, is generally recognized as the pioneer in the movement, having awarded its employees ground for gardening each year since about 1897. The war period gave great impetus to community gardens, and not only industrial workers but also school children turned vacant plots of ground to use for this purpose. War gardens were, however, the emanations of patriotic zeal. The average individual did not lack for money, and he grew vegetables in the same spirit that he bought Liberty Bonds—to help a cause. Current gardening activities are more serious matters from the individual or family viewpoint. They are born of conditions of stress: they provide needed food and enable workers to spend at least a portion of their time productively.

Industrial gardens are this year taking many forms. In St. Louis, General Electric Company has turned over surplus land to the Citizens' Committee on Relief for the use of community residents irrespective of whether or not they ever worked for the company. Some of the gardens are far flung: the Erie Railroad, for example, has placed at the disposal of its workers some 1,500 acres of land made up of vacant lots along its right of way between New York City and Chicago. In some instances the sponsors charge a small fee for the use of the ground, in others they give it free. The policy as regards furnishing seeds, preparing the land, fertilizing it, and providing tools likewise varies widely.

At Phillipsburg, N. J., where "Jackhamers" and other compressed-air machines are made, Ingersoll-Rand Company is carrying out a plan under which approximately 1,000 furloughed and part-time employees are raising

BEFORE

This view shows a portion of one of the garden tracts as it looked on March 26.

vegetables. The gardeners contribute only their time, as the company prepared the ground, furnished the seed, and is supplying the necessary implements for cultivating and spraying. The produce belongs to those who raise it; and they may use it themselves, give it away, or sell it. There are 373 gardens on company property and 630 home gardens, aggregating more than 100 acres.

The company gained some experience in this line of endeavor during the World War. Some of the many employees who had war gardens on company land asked permission to continue the practice, and have raised vegetables each year since then. A few of the men became expert; and when the present plan was drawn up they were very helpful. One of them, an employee of the carpenter shop, had a prize garden fifteen years ago, and a great many of the present plots are laid out according to the scheme he used at that time.

With the county agricultural agent and the New Jersey State Agricultural Department assisting, the company formulated plans for the gardens early last spring. All men removed from the payroll since January 1, 1931, and all present employees, were eligible to participate. Two areas of company ground were available. Both were heavily overgrown, and the first step was to clear them. This was completed by the end of March, and the ground was then plowed and harrowed, after which 1,500 pounds of fertilizer to the acre was sowed and drilled. The next step was to lay out 50x100-foot lots, and to place corner stakes and designating numbers. Wide dividing alleys were left every 400 feet, and 6-foot alleys every 100 feet to give free access to the gardens. Water mains were laid with outlets at convenient points.

Meanwhile, seventeen varieties of vegetables had been selected for planting, and blueprints had been prepared of three typical lots showing different planting arrangements that might be followed. Seeds were purchased in bulk and placed in packages which contained amounts sufficient to plant the number of rows specified in the typical lot plans. Seeds were given out from April 13 to May 15, at which time the distribution of tomato, pepper, and cabbage plants began. Each lot holder received a blueprint chart containing recommendations as to the spacing of rows, the distance to be allowed between seeds, the depth to plant, when to start and stop planting, and the amount of seed required for a 100-foot row. All rows were laid out lengthwise of the lots.

A veteran gardener among the employees was made supervisor. In addition to looking after the distribution of seeds, tools, etc., he served as counselor to those who had special problems which they could not solve. Hand cultivators were provided and were circulated among the lot holders so that each had a chance to use them. Additional cultivators were sold at cost for use by home gardeners. When insect life, blight, and other harmful agencies made their appearance, the company distributed blueprinted information regarding each one, with recommended sprays and detailed directions for applying them. Spray outfits and the required spraying materials were made available for use.

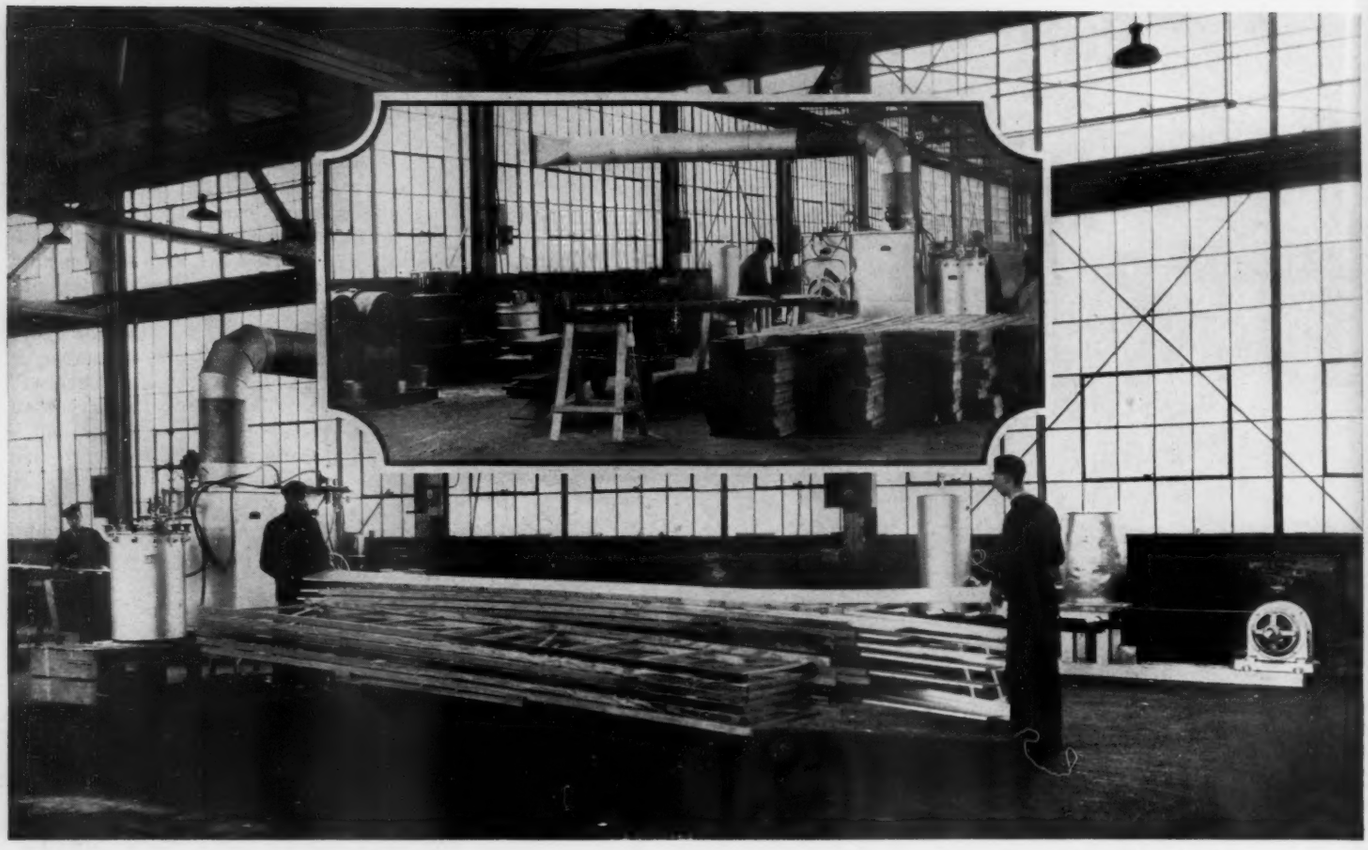
The gardens began to yield vegetables in June and will continue to produce until well in the autumn. The amount of produce that will be raised has not been estimated, but it will run into many tons. The onion sets that were put out would make a row nearly 30 miles long. More than 550 bushels of seed potatoes were used, all of which were dipped for scab before planting. Forty-four thousand tomato plants, 45,000 cabbage plants, and 26,000 pepper plants were placed in the ground.

Each lot holder signed an agreement that he would properly care for his garden. Company officials state that these agreements have been kept almost without exception. Most of the gardeners have displayed great pride in their work. At least 95 per cent of the lots can be classed as excellent examples of the gardener's art. In many cases, wives and children have assisted in the cultivation. The movement has had the effect of furthering friendly relations between the men and the company, and it is probable that it will be continued in future years.

One of the staff engineers of the plant assumed supervision of the undertaking and devoted at least half his time to the work for several months. It is estimated that the company expended from $10 to $12 on each lot, of which approximately one-third went for seeds.

AFTER

A picture made on June 30 from almost the same spot as the one shown above.



Courtesy Binks Manufacturing Company

Priming siding in the mill of the Aladdin Company, Bay City, Mich. In the lower right-hand corner is the compressor plant that supplies air for spraying the paint and for other purposes.

Mill-Primed Lumber for the Housebuilder

Special Air-Spray Equipment Is Used to Apply Protective Coats of Aluminum Paint

A. M. HOFFMANN

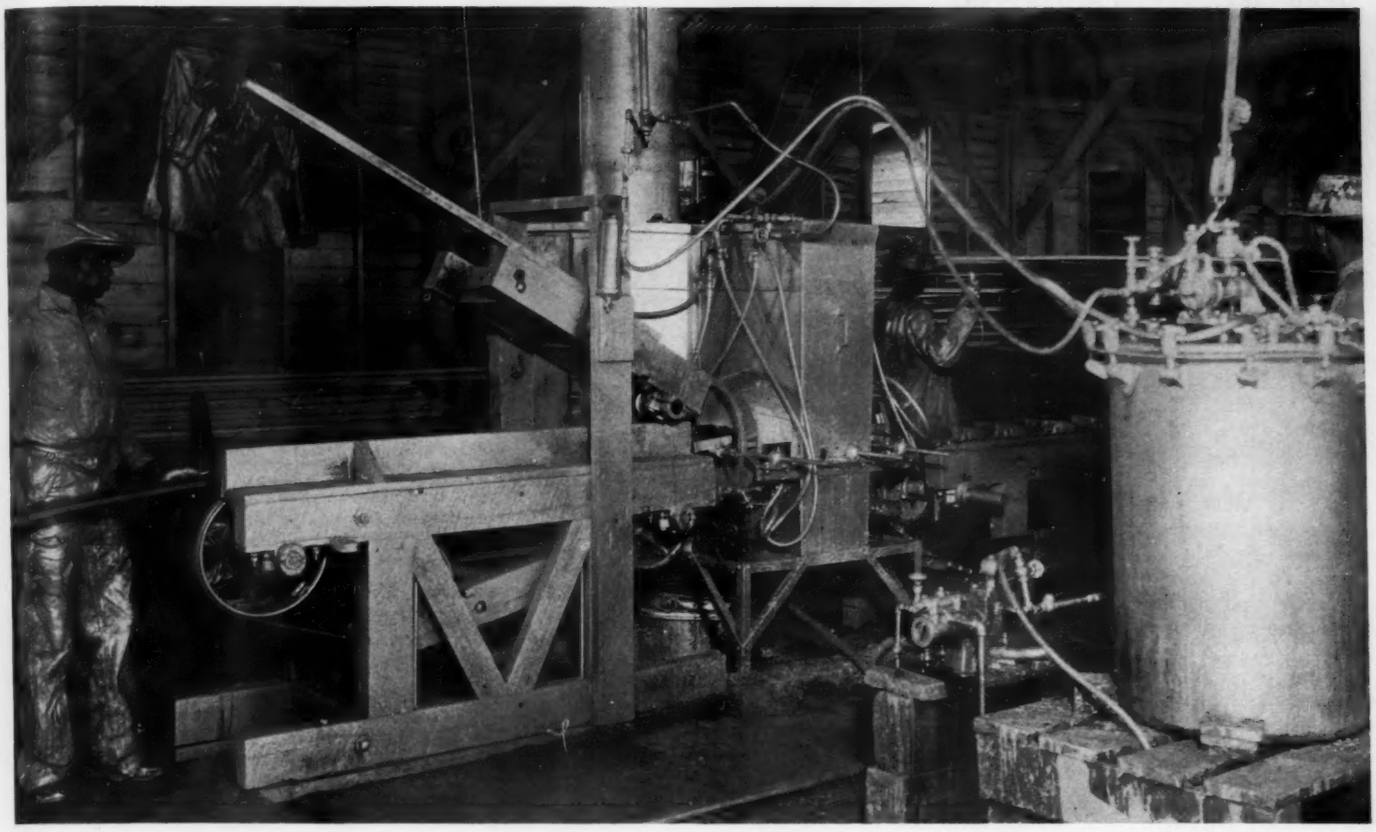
BUILDING materials of all kinds, whether of wood, metal, or stone, are ceaselessly subjected to the destructive action of the elements—to the harmful effects of moisture, sunlight, and, in certain climates, to alternate thawing and freezing. To offset these and to prevent deterioration, research men have gone about providing ways and means of protecting those materials in one way or another until, today, the savings that have thus been made possible in the United States alone are said to mount into millions of dollars annually. Waterproofing compounds, paints and varnishes, and a long list of preservatives of different kinds have all helped to contribute to this sum total.

Despite the much that has already been done to this end, the man in the laboratory continues to wage war against these destructive forces of Nature, knowing full well that while they cannot be stopped they can be counteracted by the use of proper preventive measures. One important step that has been made of late in this direction is the priming of siding lumber at the mill.

It goes without saying that much can happen to kiln-dried uncoated siding between the time it is shipped from the mill and the day it takes its place in a structure. The object of seasoning is, of course, to reduce the moisture content to such an extent that the lumber will not shrink, swell, warp, or check after application and that the paint with which it is subsequently coated will give a maximum of service. But what has been accomplished in the kiln may be largely undone through exposure while the material is in transit, in a dealer's yard, or at a building site. It may reabsorb an undesirable quantity of moisture, or it may become infected in one way or another through contact with other lumber or the ground. It is to obviate this and to assure the delivery of a product that is in good condition that some mills are now prepared to give the lumber a priming coat of aluminum paint shortly after it emerges from the kiln. It is just another case of the proverbial "ounce of prevention".

Aluminum paint was chosen for the purpose for a number of reasons. Chief among these are that it is highly moistureproof and provides a well-nigh unbroken metallic film that offers much resistance to the damaging effects of sunlight and oxygen—factors which combine to cause flaking and peeling and, consequently, exposure of the underlying surface to the weather. It also serves to check stain-bleeding—that is, to prevent the appearance on wood of discoloring stains from exterior sources. For this purpose it has been used by painters for many years. Because of these characteristics, aluminum paint forms a good base for the application of additional or top coats of ordinary house paints.

Lumber-priming machines have been especially developed for this work by several of the spray-paint-equipment manufacturers in the United States. They differ little in general principle, and consist in the main of a reclaiming type of spray booth provided with "guns" that can be adjusted to any angle and with removable covers that permit ready access; of a pressure paint container with an air-operated agitator; and of a compressor with an oil and water trap. The priming machines function automatically and are installed in conveyor lines for speed



Courtesy Aluminum Company of America

Down South in the mill of the Stover Manufacturing Company. This mill is well equipped to give lumber a coat of paint after it has been seasoned so as to protect it during storage and in transit.

of operation. This is essential in handling a commodity such as lumber. The boards, one at a time, are passed through the machine, emerging at the discharge end uniformly and entirely coated—faces, edges, and ends. There they are placed on racks for drying preparatory to bundling, or they can be directed through a continuous oven if they are to be loaded at once for shipment. The roller-conveyor systems are spiked and provided with suitable guides to prevent marring the finished surface. The capacity of these machines is said to be limited only by the speed with which the lumber can be handled at either end. For example, a speed of 108 lineal feet per minute was obtained with one man feeding and two at the discharge. This was increased to 200 lineal feet per minute when another man was put at the inlet end and two more at the outlet end. The average capacity, however, is between 100 and 125 lineal feet per minute. From 20,000 to 25,000 board feet per day has been turned out in actual practice.

The man stationed at the spray booth completes the working force. He is in charge of the valve that controls the entire priming mechanism. A turn of this valve in one direction starts all the spray guns in the cabinet: a turn in the opposite direction and they cease to function—their supply of paint and compressed air is cut off. Compressed air is used not only to atomize the paint and to force it from the pressure container to the guns but also to drive the air motors that operate the toothed conveyor rolls in the spray box and the agitator that keeps the metal particles in suspension. The tanks vary in capacity from 60 to 65 gallons, enough to keep a machine going continuously at top speed for at least half a day. The excess spray is reclaimed by means of baffle plates set in the exhaust chamber.

The priming machine that has been described is what is known as the manually operated type. There is also an electrically controlled kind that differs from the first only in that the starting and the stopping of the spray guns are effected by the aid of photo-electric cells. Two of these "electric eyes"—one for each group of guns—are set up outside of the booth and in line with two semaphores. These are connected by shaft with tripping mechanisms inside the booth and in the path of the lumber. When a piece of siding on its way through the machine comes in contact with the first trip lever, the semaphore at the other end of the shaft is caused to pass between the associate photo-electric cell and the light that is focused on that cell. What happens? A relay is operated, and this, in turn, opens an air valve through the medium of a solenoid, thus starting the first group of guns that primes one face, side, and edge of the board. As soon as the piece of siding has left the first trip lever behind, the guns stop spraying. This cycle of operations is repeated in the case of the second trip lever and the second set of guns which coats the other face, side, and edge of the board.

In appraising lumber primed with aluminum paint at the mill, a purchaser should be mindful of the fact that siding as ordinarily used for housebuilding is not painted until after it has been put up, and then only the surfaces exposed to the weather are coated. This is not ideal, as the inner surfaces or backs of the boards—as well as laps, ends, and edges—are thus left entirely unprotected and continue to be exposed to the harmful effects of moisture, which may reach them either from within or from without the structure. By giving lumber an all-around priming coat of paint at the time it comes from the kiln, and when it is in best condition to receive it, the mills are rendering a valuable service—a service that is said to cost the consumer less than he now pays for what might be called a half-done job and for a commodity that may have been damaged through changes undergone in transit. While the figures probably vary, it is reported that siding can be spray painted as described at a cost to the lumber manufacturer of from $8 to $10 per 1,000 board feet.

The latest development along this line is in the priming of window and door frames and interior trim; and it is probably not overstating the fact to say that the day is not far off when lumber mills generally will be equipped just as most steel mills now are to deliver their various products suitably coated in order to protect them and to give them longer life.

MODEL MONUMENTAL STONE PLANT

ANYONE entering the plant of the Blaesing Granite Company in Portland, Ore., is apt to get the impression that he has made a mistake and wandered into an art gallery instead of a granite-cutting plant. He will find himself in a spacious showroom surrounded by monuments and by twenty large mural paintings depicting scenes in ancient Egypt. The exterior of the building is in keeping with the interior, being Egyptian in architecture, and is faced with granite from British Columbia, Minnesota, and Tennessee that has been cut, sculptured, and polished by the company's own workmen.

The Blaesing Granite Company was organized in 1896 by H. J. Blaesing; and the appearance of its establishment is but one phase of the progressive spirit that has always been back of it. In the early days, like every artificer in stone since the days of King Solomon, its craftsmen used hand chisels and hammers. But when pneumatic tools began to take on the brunt of the hard work, to deliver the wearying blows, the company was not slow in becoming "compressed-air minded".

Starting on a modest scale with a small compressor and a few tools in 1912, the plant, with the exception of two electric cranes, is now air-operated throughout. It is provided with a compressor that supplies power, as may be required, to two sand-blasting outfits, two surfacing machines, two "Jackhamers", two plug drills, and ten chipping guns of different sizes. The upkeep of this equipment, so that it may at all times be in readiness for service, is the particular concern of Mr. L. C. Lamser, the superintendent.

The methods in use are very much like those practiced in any shop specializing in the production of monumental stone. When a design or lettering is to be cut into the face by sand-blasting, the surface, for the ordinary run of jobs, is coated with wax—great care being taken to remove right down to the stone every particle of the plastic material exposed by the pattern that has been laid upon it. Carborundum is the abrasive employed; and this is applied from varying distances and for different periods, depending upon the depth of cut desired. On large pieces of work, a proprietary substance known as "Columbus Glue" is substituted for the wax, and "Jiffy Stencil", which comes in sheets, facilitates the work of reproducing small designs.

To protect the operator from the flying particles of abrasive, he is separated from the sand-blast room by a closely fitting roller curtain. This is called a "shooter curtain", and has an opening just large enough to admit his rubber-encased hand and arm and is fitted with a removable plate of glass that enables him to see what he is doing. These men acquire great skill with practice; and they do beautiful work with astonishing speed, for it is nothing short of astonishing to be able to engrave deep in granite 450 letters in 3½ hours. This was done by the use of a special carborundum applied with air at 120 pounds pressure.

Ornamental entrance to the showroom of the Blaesing Granite Company of Portland, Ore.

The officers and staff of the Blaesing Granite Company are: H. J. Blaesing, manager; H. J. Blaesing, Jr., designer; L. C. Lamser, superintendent; and George R. Baker, sales manager.

SAPPHIRES, MINK, AND GOATS

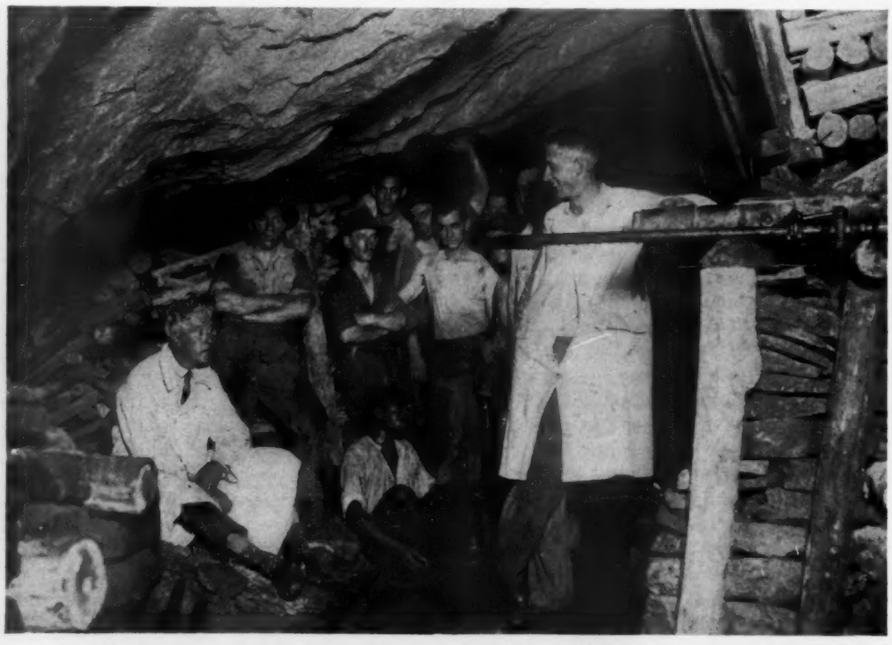
SPECIALIZATION may be the order of the day, but there is something to be said for diversification, especially in these times when it might enable a man to fall back on one occupation when another fail him. There does not seem to be any connection between sapphires and mink, but C. T. Gadsden, superintendent of the Yogo Gulch workings of the New Mine Sapphire Syndicate in central Montana, divides his time between the mining of the gems and the breeding of mink. Formerly he also went in for goat raising, but now he keeps only a few prize animals for their milk, which he likes to drink.

When the demand for sapphires is brisk, Mr. Gadsden turns his attention to the mine and the production of the stones which, depending upon their size and quality, are used by lapidaries and for the manufacture of bearings for watches, clocks, and other delicate instruments. But when there is no market for the gems, he devotes himself almost exclusively to the little fur-bearing animals that have won blue ribbons for him in this country and in Canada. Dissimilar as these jobs are, he is apparently making a success of both, at the same time keeping busy the year round and supplying the trade with sapphires under circumstances that might otherwise make it impossible for the mine owners to do so.

A COURT TRIAL SEVEN THOUSAND FEET UNDERGROUND

THE "deepest" legal case on record was tried recently in the bowels of the earth beneath Johannesburg, South Africa. To view the scene of an infraction of the mining laws, the judge, court officers, and witnesses in the case visited the 27th level of the City Deep Gold Mine, 7,000 feet underground and 1,200 feet below sea level. With the temperature around 100° F., court was duly convened and evidence presented for an hour and a half. The presiding magistrate, S. J. H. van Schoor, improvised a bench on a pile of rocks and mopped the perspiration from his brow at frequent intervals as he heard the witnesses.

The case arose when a European miner was charged with contravening the Mines, Works, and Machinery Regulations. He was alleged to have fired a round in a stope without first making certain that all entrances to the chamber were effectively guarded. As a result, a native was injured. The defendant was found guilty and was sentenced to pay a small fine or to serve fourteen days in jail.



(C) Rand Daily Mail, Johannesburg.

The magistrate is seated at the left: the prosecutor stands at the right.

COMPRESSED AIR HELPS TO STRAIGHTEN CAR DOORS

Courtesy Railway Mechanical Engineer

This air cylinder on wheels makes it possible to straighten drop doors of gondola cars without removing them.

SINCE January of 1930, when the Illinois Central Railroad Company put into effect a so-called unit freight-car-repair cost system, many simplified means and methods of working have been introduced in its various shops. Some of these depend upon compressed air for their operation, and have been developed at the points where they are used.

At Centralia, Ill., for example, there is in service a pneumatic device that straightens the drop doors of composite gondola cars without removing them. This job is among the first in the repair line as laid out under the system, and formerly was done only at the expense of much time and labor because of the difficulty experienced in getting the doors back into position so that they would be tight when closed.

The work is now done by a portable machine which jacks up one side of the car so that a block can be set under it and be so spotted that its upper end rests against the part of the steel door that is out of alignment. The equipment, as the illustration shows, is nothing more nor less than an air cylinder that is connected to the shop air line by means of a flexible hose. The cylinder is mounted on wheels and provided with a long handle to facilitate shifting. Once the car is raised by admitting compressed air to the cylinder, and the block properly placed, the release of the pressure not only permits the car to settle but to straighten the door as well—the weight of the descending body bringing this about. Of course, this applies only to gondola doors that are not badly damaged. With a little practice, the gangs on this repair work soon acquire skill in the handling of the air-operated straighteners, and dispose of door after door satisfactorily in short order.

GUNITE-CONCRETE BOND FIRM AFTER YEARS OF SERVICE

JUST how strong may be the bond between a coat of gunite and the underlying material was discovered not long ago when a bridge over the Pennsylvania Railroad tracks in Pittsburgh, Pa., was demolished. The structure had been built in 1880, and 28 years later the lower parts of the beams and girders were encased in concrete. In 1919. it was found expedient to apply a protective coat of gunite to the concrete where locomotive blasts and gases had caused it to deteriorate.

Pneumatic hammers were used to remove the masonry in tearing down the bridge; and even under the impact of those powerful tools the bond between the gunite and the concrete held. Upon examination of some of the pieces it was revealed that the No. 14 gage black tie wire, which had been used to fasten the shooting strips and which was subsequently covered with a ½-inch flash coat, was not discolored and showed no loss in sectional area. This proved that the flash coat, which had been exposed to the direct attack of the locomotive blasts for twelve years, had remained impermeable. A sample cut from the gunite where it was $1\frac{9}{16}$ inches thick was found under test to have a compressive strength of 16,700 pounds per square inch, according to the Cement Gun Construction Company.

STEEL WALL TO KEEP SKIDDING CARS ON ROADWAY

© Halbran, New York

THE accompanying illustration shows workmen erecting the first section of a steel barrier which is designed to bring an end to the serious automobile accidents that have all too frequently taken place on that portion of Riverside Drive, New York City, which takes the form of a curving viaduct 75 feet in the air.

On several occasions in the past, skidding cars have mounted the curbing, plunged through the outer railing, and fallen to the street below. Several changes were made in the surface of the roadway without eliminating accidents. More recently, a 14-inch steel curbing was installed; but it did not prove sufficient to stop cars from occasionally going off the road.

The steel wall is set back from the curbing a few inches, and is designed not only to stop automobiles from crashing through it but also to prevent them from turning over.

Courtesy, Maintenance Engineering

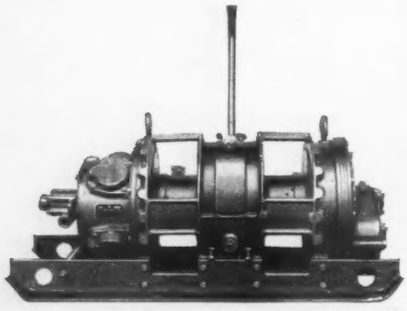
Spray painting has brought into being a wide variety of conveyors to meet the needs of the articles handled. Here we have a Mathews roller conveyor system that carries heavy gasoline pumps in and out of a spray booth in the plant of The Pennsylvania Pump Company. Painting is facilitated by a turntable interposed in the conveyor line in the spray booth and controlled by the operator.

That the giant *Akron*, the navy's American built dirigible, is to carry five airplanes inside of her is a generally known fact; but what means are to be used to handle them aboard the craft is news. To get the flying machines out of their floating hangars, or to house them once they have been lowered into the airship, the latter is now being equipped with an overhead monorail system that has been especially designed and constructed by the American Monorail Company of Cleveland, Ohio.

DOUBLE-DRUM AIR HOISTS OF THE "UTILITY" TYPE

TO ITS well-known line of "Utility" air hoists, Ingersoll-Rand Company, 11 Broadway, New York City, has added four new sizes with double drums. These hoists have been designed especially for slushing and scraper loading in mines and quarries, in sand and gravel pits, and elsewhere where double-drum hoists are required.

In announcing these new units, the manufacturer stresses the single-lever control of the clutches and throttle valve which assures ease of operation and safety. The lever is located at the center and rear of the hoist and works on the "joy-stick" principle. Swinging the lever sidewise engages the clutch for either of the two drums, and pushing it forward admits compressed air to the motor. The speed of the motor is regulated by the position of the lever. Variations in drum speeds are obtained by means of the lever and without the need of slipping the clutch. Another outstanding feature is the reduction



Front view of the Size HX "Utility" hoist.

in air consumption, as the motor is required to run only when the hoist is actually pulling. The control lever automatically returns to neutral when released—a safety measure.

A compact, cylindrical, cast-steel housing fully protects the drums, clutches, and brakes and insures proper alignment of all the moving parts. The drums are provided with internal expanding clutches, one for each drum, and are under the control of the single lever. Only one clutch can be engaged at a time. The main gears are of the helical type which tends to lessen tooth pressure and to make for noiseless operation. The air motor is of the radial, 4-cylinder type, and is similar to that in the single-drum "Utility" hoists—a design that has proved to be dependable and efficient. The hoist, complete, is securely fastened to strong steel skids to facilitate spragging, mounting, and moving it under its own power.

The four sizes are known as the HX, HXC, KX, and KXB. The HX has a rated capacity of 1,500 pounds pull at a speed of 175 feet per minute, while the HXC and the KX are rated at 2,000 pounds pull at speeds of 130 to 215 feet per minute, respectively, and at 80 pounds pressure. The KXB was built especially for use with low-pressure air. It has a rated capacity of 2,000 pounds at a speed of 140 feet per minute and at 60 pounds pressure.

FIREPROOF AWNINGS

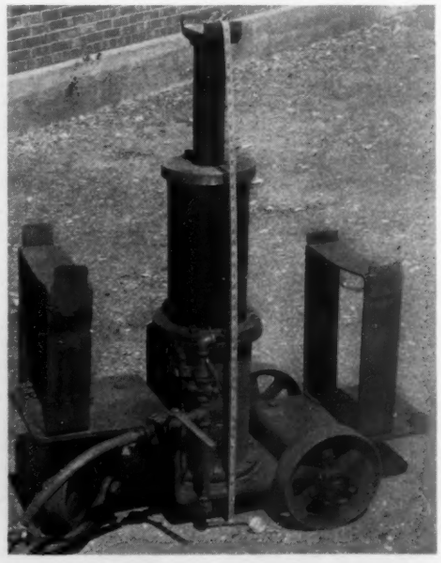
NOW that fireproof awnings are promised us, smokers who have the bad habit of throwing their lighted butts out of windows will probably mend their ways. Be that as it may, certain large cities that have prohibited the use of awnings on tall buildings because of the fire hazard will, as a result, no doubt see fit to repeal those ordinances.

Asbestos is the base of the fabric, which is woven and colored by the application of paint. It is said to be pliable, light, and strong; and is to be sold to awning makers under the names of painted awning tint and painted awning stripe—differentiating the solid from the gayly decorated material.

TELESCOPING AIR JACK FOR USE IN RAILROAD SHOPS

TO DO away with the use of blocking in applying couplers and draft gear, the Milwaukee, Wisc., freight-car shops of the Chicago, Milwaukee, St. Paul & Pacific Railway has devised a telescopic air jack that minimizes the dangers heretofore incident to the work. The essential feature of the jack, which is mounted on a 3-wheel truck for easy portability, is an air cylinder in the bore of which is another steel cylinder with an auxiliary piston and plunger. As a result of this arrangement the action of the jack is a telescoping one, and the travel of the piston head is about double what it would be under ordinary circumstances. Its total reach from the ground is 47 inches.

With the piston head in its lowest position, the draft gear, let us say, is placed on two supporting brackets secured to the truck and hauled beneath the freight car. When spotted, compressed air is admitted to the cylinder, and the draft gear is raised into position in one lift. It is in this that the shop-made jack differs from other pneumatic jacks used for this work. The latter usually require at least two lifts to complete the operation.



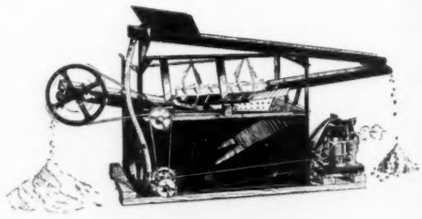
Courtesy Railway Mechanical Engineer

Telescoping air jack designed especially for the application of couplers and draft gears.

EVEN THE PROSPECTOR'S GOLD PAN HAS NOW BEEN MECHANIZED

THE vast increase in gold-panning during the past two years has challenged inventive genius to the point where a portable placer machine, designed expressly for use by mining engineers and prospectors, has made its appearance on the market. This mechanical gold pan weighs only 210 pounds; can be placed, when dismantled, upon the rear seat of an automobile; and is priced low enough to be within the reach of many prospectors. It is produced by a reputable mining supply company, and is reported to have proved its practicability over a period of several months of testing in the field.

The accompanying illustration gives a good idea of its construction and manner of operation. It screens and washes gravel at the rate of more than 1 cubic yard an hour. A shaking riffle for trapping the gold is hung on two cradle arms, and is accessible for speedy cleaning. The apparatus is driven by a gasoline engine that uses only 1 gallon of fuel every eight hours. It has a closed-water system which utilizes over and over again the contents of a 42-gallon tank. By



Sketch of the mechanical gold pan.

means of a conveyor which discharges and dewaters the tailings, a settling tank, and a pump, the water is made to do continuous duty. This feature fits the mechanical gold pan for use in desert areas which have previously not been fruitful ground for placer operations. When taken apart, all members of the machine can be packed in the water tank, which measures 35x16x21 inches.

It is claimed that the new mechanism will save virtually all the coarse gold contained in sand or gravel, and will make recoveries of 93 per cent of flake gold and 89 per cent of flour gold.

PROTECTIVE PAINT FOR STEAM AND HOT-WATER PIPES

AFTER more than two years of experimenting and testing, the American District Steam Company, of North Tonawanda, N. Y., claims to have produced a protective paint for steam pipes and hot-water lines. The paint has been named Adsco Pipe-Kote 505 and, according to the manufacturer, is impervious to heat generated by steam; is immune to the action of moisture, dilute acids, and alkalies; and the coat, though hard, is sufficiently elastic to expand and contract with the pipe without cracking or peeling. Pipe-Kote is recommended besides for use on gas and water mains, stacks, boiler fronts, and all surfaces that are exposed to extreme or rapid changes of temperature and atmospheric conditions.

DREDGING ON THE PANAMA CANAL, by John G. Claybourn. An illustrated, 261-page book, published by A. Kroch, Chicago, and also obtainable from Compressed Air Magazine. Price, $2.50.

THIS book describes the methods and equipment used in the construction of the Panama Canal and in the maintenance and improvement work that constantly goes on there. Mr. Claybourn, superintendent of the dredging division under the department of operation and maintenance of the Canal Zone Government, has been associated with these activities for 22 years. Throughout that period he has been collecting data with the purpose of some day presenting the facts regarding this huge construction undertaking. In compiling his book, the author has had in mind as prospective readers both the engineer and the layman. Much of his information is technical in character, but it has been prepared in such a manner that it makes interesting reading. It is the first account which reviews the entire work from its inception to date.

As the casual newspaper reader knows, vast maintenance and improvement operations are required to keep the canal functioning smoothly. Slides have been particularly annoying and have placed a great burden upon the men charged with keeping the great interocean carrier open and effective. In addition to their emergency duties, these forces have been engaged continuously in protective measures to prevent slides. Methods devised by Colonel Goethals have been followed and have reduced the frequency of the earth movements.

Mr. Claybourn has not attempted to dramatize a dramatic subject. He has contented himself with setting down, in chronological order, the story of what has been done and how it was accomplished. The account contains many statistics, but they are not boring. They serve rather to illuminate the word picture and to emphasize the enormity of the operation. The book is illustrated with 80 full-page reproductions of photographs which portray in graphic form the diverse and unceasing duties of the dredging division.

ROAMING THE EASTERN MOUNTAINS, by John T. Faris. An illustrated work of 319 pages, published by Farrar & Reinhart, Inc., New York. Price, $3.00.

THIS most recent of a long list of travel books by Doctor Faris describes the highways and byways of the Appalachian Mountain System which begins in Newfoundland and stretches southward 1,500 miles into Alabama. It is a personally conducted tour of these vast and interesting uplands, presented in pleasing fashion by one who has spent many years seeing and writing about the great outdoors. Doctor Faris takes the reader out on trails with him, and recounts in entertaining language the chief historical points of each place visited while at the same time describing its scenic appeal. The mountain lover and the person who must do most of his traveling vicariously will find this book pleasant and informative.

A PRIMER OF MONEY, by Donald B. Woodward and Marc A. Rose. An illustrated book of 261 pages, published by Whittlesey House, New York. Price, $2.00.

THE title of this book summarizes its contents. It explains, in simple terms, the organization and significance of the monetary system which concerns us all but about which most of us are sadly ignorant. A reading of its pages will enable anyone to understand more clearly the complications of the present economic unsettlement. Such subjects as the gold standard, bimetallism, inflation and deflation, exchange, the relationship of money and prices, and kindred topics, are dealt with in plain, comprehensible English.

Mr. Woodward is financial editor of *The Business Week* and Mr. Rose edits the same publication. They have written for the average man or woman with the intent to expound rather than to theorize. They begin with the history of money and carry the account, step by step, up to the second half of the discussion, *Money Problems of the Modern World*. With the underlying principles here set forth at his command, the reader need no longer find obscurity in much that he reads in the newspapers about national and international finance.

IF I WERE OUT OF A JOB, by G. P. Blackiston. A booklet of 56 pages, published by The Blackiston Organizations, Canton, Ohio. Price, 15 cents.

THE author, Mr. Blackiston, heads an advertising and publicity organization that has had an insight into the workings of many industrial firms. Out of his experience he has come to know what things employers seek and what talents the average individual possesses that he can capitalize. The book is practical and it is specific. It contains much that should help the unemployed man or woman secure something remunerative to do.

THE CHEVROLET SIX CAR AND TRUCK, by Victor W. Page. A book of 480 pages and 150 illustrations, published by the Norman W. Henley Publishing Company, New York. Price, $2.00.

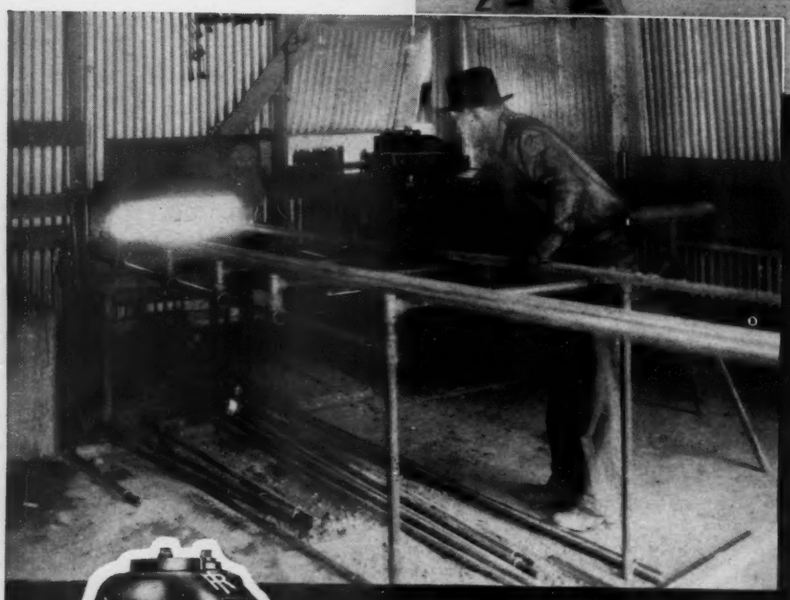
MR. PAGE, a member of the Society of Automotive Engineers, here adds another very practical volume to the list of those he has previously written upon the subject of automobiles. This book is designed to afford Chevrolet owners an intimate view of the machines they drive. It is a complete non-technical treatise detailing the mechanical features, operation, maintenance, and repair of the latest models of this make of automobile. It is so thorough that study of it will enable any mechanic to become an expert workman upon Chevrolet cars. Its value to the casual pleasure and business driver lies in the fact that it will show him how he may derive more benefit and a maximum of service from his car through proper care and driving. To the more prudent ones, it offers a course of instruction which will show the way to savings through personal maintenance and repairs.

A folder of interest to users of small pumping units has been issued by Ingersoll-Rand Company, 11 Broadway, New York City. It is descriptive of their new line of Motorpumps, which can handle anything from water to tanning extracts, and even inflammable liquids—that is, a wide variety of clear, gritty, and pulpy fluids. They range in size from ¼ to 25 hp., and can pump from 5 to 800 gallons per minute. Motorpumps are delivered complete with built-in electric motors suitable for all conditions of service.

Briggs & Stratton Corporation, Milwaukee, Wis., has issued a folder describing and illustrating uses for a new product, the "Air Saver". This is a leakproof valve that was originally developed for use in the company's own plant and which proved so successful that it was later decided to market it. However, before the product was offered generally, several hundred installations were made in various plants for testing it thoroughly. The valve furnishes automatic, intermittent control of compressed-air blasts for ejecting work, keeping dies and tools clean, etc. It is used on punch presses and other machines where drilling, broaching, reaming, and kindred operations require controlled air blasts in the interest of longer tool life, greater accuracy, higher efficiency, more production, and better quality of work.

Tests of Rock-Dust Barriers in the Experimental Mine, by George S. Rice, H. P. Greenwald, and H. C. Howarth, is a report by the United States Bureau of Mines which covers experiments and observations made in the Bureau's experimental coal mine near Pittsburgh, Pa. The conclusion drawn is that the effectiveness of a rock-dust barrier in preventing the spread of a mine explosion depends upon its proximity to the point at which the blast originates. The report is in the form of an 81-page pamphlet designated as Bulletin 353, and is obtainable for 10 cents from the Superintendent of Documents, Washington, D. C.

I-R Blacksmith Shops at the Hoover Dam



Above, one of the first blacksmith shops to be put in operation. Left, a close-up view of another shop, showing sharpener and oil furnace in operation. Below, the No. 50 sharpener that is so widely used in all parts of the world.

AT the peak of the drilling operations at the Hoover Dam, there were as many as ten completely outfitted blacksmith shops for reconditioning the great amount of drill steel required for the job. Many thousands of bits and shanks were reconditioned every 24 hours during January, 1932, when the work in the tunnels was being pushed at top speed.

I-R sharpening equipment was used in each of these blacksmith shops. It included a No. 50 drill-steel sharpener, a No. 26 oil furnace for heating the steel, a No. 8 grinder for squaring shanks, and a No. 6 drill for opening plugged steel.

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